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ON THE GENERA OF THE DIPNOI DIPNEUMONES.

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The Dipnoi are a group of piscine vertebrates, unusually interesting, alike to the morphologist, the paleontologist and the physiologist. Hitherto these animals have proved, in many respects, unsatisfactory objects of study, since the existing forms have been accessible to but few workers, and then only as more or less poorly-preserved alcoholic specimens. Only within the last few years has this condition of things changed so that quite recently our knowledge of this group has been enriched by many interesting and important additions to the morphology, physiology and the general biology of two of the members of the group representing the two commonly accepted genera.

The papers containing the results of the researches upon the living specimens of *Lepidosiren annectens* we owe to Professor J. Waldschmidt, who has worked out the Dipnoan brain from the comparative standpoint, and in histological detail, and to Professor W. N. Parker, who has studied in more or less detail almost all of the organs of the body except the skeletal and nervous systems. His study was directed to the solution of the numerous points left unsettled by previous workers who were less favored in the quality of their material, and not to a fundamental research into the nature and relationships of any

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of the organs of the body. Professor Parker has gone over the ground covered by my paper on the anatomy and physiology of the Dipnoi,² and has cleared up some of the things which I was unable to carefully study, owing to the fact that the only material accessible at that time consisted of store-bought alcoholic specimens, intended, without doubt, for museum collections. Hence, it not unfrequently happened that questions depending upon histological detail could not be satisfactorily or finally solved. On the other hand, Parker has arrived at some conclusions which I think are hardly justified in the present state of our knowledge, and it is to these matters that we will now confine our attention. In my Freiburg paper I suggested that it was hardly permissible to maintain two distinct genera of the Dipneumones, and I based my suggestion upon the lack of adequate structural differences between the forms commonly held to be generically distinct. I proposed on that account to use the name *Lepidosiren* instead of the name *Protopterus* for the African species, and I called attention to the great scarcity of the individuals of *Lepidosiren paradoxa* in museum collections.

My remarks, and more especially the adoption of the name *Lepidosiren* as the sole genus of the *Dipneumones* had the effect of calling out a reply from the late Professor Anton Schneider, of Breslau,³ and also an article by Dr. George Baur,⁴ of Chicago University.

Quite recently, Parker publishes his agreement with the conclusions of Schneider and Baur as far as the generic distinctness of the African form is concerned. It may be of interest to the uninitiated to know that none of the recent writers have ever seen a fragment of a *Lepidosiren paradoxa* from South America, and we all alike depend upon the published accounts of this creature's anatomy by Bischoff, Hyrtl, Klein, and a few others, all of whose investigations were made on two or, at the most, three animals, and some of the workers had at their disposal for study only the material which had already been dissected by their predecessors, e. g., Hyrtl. Their papers were published some years ago (in the 40s or 50s), and leave much

to be desired when examined for the solution of the problems of to-day.

Schneider's paper was based upon original investigation of a considerable number of African mud-fish from several widely-separated localities, and his conclusions are that *Protopterus* is not only generically distinct from *Lepidosiren*, but that there are also two well-defined species of the African form, to be separated on account of the number of ribs, the presence or absence of the cartilaginous fin-rays and some other characters of no importance here. Baur's paper is an historical resumé of the main facts about *Lepidosiren paradoxa*. In general, however, the reasons which have been given for keeping *Protopterus* distinct from *Lepidosiren* may be concisely stated as follows:

1. The presence of 4 gill-holes in *Lepidosiren* and 5 in *Protopterus*.
2. The presence of a larger number of ribs in *Lepidosiren*.
3. The absence of fin-rays in *Lepidosiren* and their presence in *Protopterus*.
4. The absence of external gills in *Lepidosiren* and their presence in *Protopterus*.

I shall now endeavor to show that the critics of my suggestion of the generic identity of these two forms have failed to bring any proof that it is not entirely reasonable and highly probable, and by their own investigation have weakened their case by discovering facts which go to prove the close relationship of these animals.

THE GILLS.

All the writers on this subject have failed to see the important agreement between the gill structures of *Lepidosiren* and *Protopterus*, and have been led off to base important conclusions on a relatively unimportant point in their anatomy. The statement which Schneider and Baur base so much upon, viz.: that *Protopterus* has 5 gill-slits, while *Lepidosiren* has only 4, certainly looks important enough to give the advocates of a

genus apiece for these creatures ample warrant for their conclusions; but when we examine the actual significance of this difference in the number of holes in the side of the neck, most if not all the value of this character is destroyed, for the number of functional gills is the same in both animals.⁵ The facts are that both animals have 5 gill-bars, but only $2\frac{1}{2}$ gills; that the first and second gill-clefts are in both forms devoid of a respiratory membrane or structures, although their secondary blood supply through the bronchial artery still persists. These two pair of gills are completely atrophied in both creatures physiologically since they no longer serve in respiration, and the denuded slits are subject to that variation which is the fate of all rudimentary organs. The first slit suffers most and is greatly reduced. In the two (or three?) specimens of *Lepidosiren* which have, up to date, been dissected, the edges of the slit seem to have grown together, while in *Protopterus*, though the slit is still open, it is very much reduced, being smaller than any of the other gill slits. I venture to say that no very large number of individuals of *Protopterus* have been examined with special reference to this point. However that may be, the coalescence of the walls of a degraded gill-slit is not a character of sufficient morphological importance to found a genus upon, except, perhaps, in the eyes of a confirmed genus builder.

In both forms neither the first nor second gill-bars bear any gill membranes, but both possess an hyoidean demibranch (opercular gill rudiment). This gill is composed of a single row of gill leaflets as in *Ceratodus*. The third and fourth gill bars are provided with a double row of gill leaflets, while on the fifth arch is found only a single row of leaflets, a condition not obtaining in any other *Dipnoan* or *Ganoid*.

When these animals were named, they were little known to science. If they had to be named as new discoveries to-day, and could both be studied together in so doing, most zoologists would include both animals in one genus, even if they did not group them as varieties of one species.

I wish to call the attention of those anatomists who would insist upon keeping *Lepidosiren* and *Protopterus* distinct upon

the basis of the number of gill clefts left open irrespective of the fact that the number of functional gills is the same, to the fact that there are other fish with a variable number of gills which are considered by as good authority as Johannes Müller, to the extent of his knowledge of the case, to be *mere varieties of one species*. Müller found among the *Bdellostomæ* from the Cape of Good Hope, individuals with 6 pairs of gills, others with an extra gill added to one side of the body, and still others with 7 full pairs of gills.

I have ascertained that, taking all the *Bdellostomids* together, they form a series in which the gill variation runs between the minimum of 6 pairs and the maximum of 14 pairs, or a DIFFERENCE BETWEEN THE EXTREMES OF 8 PAIRS OF GILLS, AND YET ALL THESE INDIVIDUALS NOT ONLY BELONG TO THE SAME GENUS—THEY BELONG TO THE SAME SPECIES!

THE RIBS.

The number of ribs has been selected by Schneider as a character of *generic* as well as specific value. The possession of 56 ribs is held to be characteristic of *Lepidosiren paradoxa*. Considering the small number of individuals examined, this cannot justly be said to be a settled fact. Schneider's diagnosis of 30 ribs for *Protopterus amphibius*, and of 35 ribs for *P. annectens* as a safe specific character, is, to say the least, ill-chosen, for the reasons that the number of ribs varies in specimens from the same locality, which have no other distinguishing characters save another variable, viz.: the presence or absence of external gills, and for the further reason that some authors (Owen, loc. cit. p. 47) have counted at least 37 ribs in *P. annectens*. Schneider failed to define what structures he would have counted as ribs; but I assume he would admit all rib-like processes attached to the bare notochord between the pectoral and pelvic girdles as entitled to be named ribs irrespective of questions of homology. THE NUMBER OF SUCH PROCESSES IS INCONSTANT IN *Protopterus*, but the extremes of variation have not been definitely made out. The number probably varies with age, but this is not certain.

Parker⁶ has shown that Schneider's second species of *Protopterus*, *P. amphibius* is a mistake. Schneider gives the Gambia as the habitat of this species. The distinctive characters separating this species from *annectens* are the presence of lateral cartilaginous rays in the fin membranes and only 30 ribs.

Schneider describes the fins of the *Protopterus* material which Peters brought from Quellimane as long and pointed, but flattened appendages. This was found to be true of the pectoral fin, the pelvic fin being thickened at its base. The cartilaginous axis of each fin bears on one side several cartilaginous rays which support the membranous border of the fin. This border is, in turn, stiffened by numerous horny filaments (horn-rays). This membrane is found on the ventral edge of the pectoral fin. Schneider found cartilaginous rays in *P. amphibius* only.

Parker states that his animals were from the Gambia, and that the specimens which he "examined for the purpose possess in the middle part of the fin, numerous cartilaginous parameres on each segment in both fins," which, according to Schneider, is one sure sign of *P. amphibius*, but Parker's animals also had 35 ribs, which is one of Schneider's marks of *P. annectens*. Parker concludes that there is possibly considerable variation in both these structures within the species, and this agrees with what Wiedersheim has previously found with respect to the FIN MEMBRANES, irrespective of their supporting structures.

EXTERNAL GILLS.

Owen,⁷ McDonnell,⁹ Schneider,³ Wiedersheim,¹⁴ Peters and Parker⁶ describe or mention the existence of external gills in specimens of *Protopterus* from the different localities of Africa. Owen's observation has already been referred to. McDonnell simply states that he found three processes, rudimentary external gills the longest of which measured 4'''.

Boas makes the following statements concerning the external gills of the African mud fish.

"Über die sogenannten äusseren Kiemen von *Protopterus* müssen wir ein Wort sprechen. Die betreffenden Gebilde waren bei den zwei von mir untersuchten *Protopteri* sehr klein,

offenbar ohne jegliche Funktion. NACH PETERS SIND SIE GEGEN BEI JUNGEN EXEMPLAREN STÄRKER ENTWICKELT. Ich glaube dass man diese organe . . . am richtigsten, oder wahrscheinlichsten, in die Reihe der vielfachen accessorischen Athmungsorgane, die wir bei Fischen finden, stellt. Ich finde es ferner sehr zweifelhaft, ob sie etwas mit den äusseren kiemen von *Polypterus* gemein haben die anderen Ursprungs, anderen Baues ist und von anderen Blutgefässen versorgt wird."

The branchial blood-vessels, as described by Peters and Owen (for *Protopterus*), are very different structures.

Parker found external gills in all of the specimens examined by him, but his largest were still comparatively small animals. He quotes Peters as finding them on fish 2-3 feet long, and that in young specimens they are thinner, while in old specimens they are broader. Parker asserts that my statement that these gills are only present in young animals is certainly incorrect. Boas quotes Peters as above, which is not in harmony with Parker's use of Peters' words. The majority of writers on this point agree that they belong to small or young animals, as is the case with the gills of *Polypterus*, and Parker's material was not sufficient to add anything to the settlement of this question.

With reference to the food habits of *Lepidosiren annectens*, there is no longer any doubt as to its omnivorous tastes.

Professor Parker has shown that it may, at times, be cannibalistic, but he errs in supposing that I maintained that it had entirely changed its food habits. Starting from supposed carnivorous ancestors, I claimed that *Ceratodus* had become essentially herbivorous in its habits, while *Lepidosiren* had only partly modified its habits in this respect. On page 510 of my Freiburg paper, Professor Parker might have read: "Der Darm ist bei *Ceratodus* stärker verändert, als bei *Lepidosiren*, und diese Verschiedenheit correspondirt mit der Grösse der Veränderung, die Function erfahren hat," and further, that "Das Futter des *Ceratodus* besteht gegenwärtig aus verschiedenen, kleinen Mollusken (reichliche Schale von Gasteropoden und Lamelli-branchiaten fanden sich im Darne), Gras, Riethgras und Zahl-

reichen anderen Pflanzen stücken." And I further ascertained that while the plant remains were not masticated, the shells had all been crushed to fragments. Now, if *Ceratodus* eats animal food, and has been modified more than *Lepidosiren* in the direction of herbivorous diet, it follows that *Lepidosiren* is also partly carnivorous.

The quotation which Parker makes from my paper, referring to the breeding habits of the Dipnoi, applies to *Ceratodus* only, and not in any part to *Lepidosiren*, and the trouble arose in the transposition by the printer, of the reference number which occurs in my MS. after the word "Beobachtung," to the next line of the printed text. The transposition escaped correction in the proof. The authority for the statement is, to the best of my recollection, *The Zoologist*, 3d Ser. Vol. VII, 1884 (?).

After a study of the pectoral fins, to which Professor Parker devoted his special attention, he concluded that they do not serve the function of feelers. This conclusion is not well-grounded, for it rests upon the author's failure to find tactile SENSE ORGANS in the skin of the appendages. Our author remarks "that the nerve supply seems out of all proportion to the rudimentary muscles, and this fact renders the absence of sensory organs all the more surprising," and, on p. 124, "So far as I have been able to observe, *all* the sensory organs in connection with the epidermis have the form of the 'lateral-line organs' described above, and in this point therefore, as in many others, *Protopterus* resembles amphibians more than fishes," a conclusion which, will without doubt prove to be too lightly drawn, for from the knowledge which we possess of nerve endings in the skin of fishes, and the methods of demonstrating them, it should not be a very difficult matter to show that the large nerve supply is, in this instance, distributed to the epithelium of the pectoral appendages in its character of a sensory apparatus.

The nerve supply indicates that the brachial nerve must contain many sensory fibers. It is composed of the first three spinal nerves, the dorsal and ventral roots of the hypoglossal, and a branch of the vagus. There is every evidence that the appendage is a very sensitive tactile organ, and the nerve-end

apparatus will be found by making a proper study of the skin.

Referring to the occurrence of taste-buds in the *Lepidosiren annectens*, Parker states that I have described somewhat similar organs on the palate of *Ceratodus*. As a matter of fact, the description I gave applied to both *Ceratodus* and *Protopterus*, though I figured the organs from *Ceratodus* alone. I am pleased to see that Parker is able to confirm my own observations in this respect.

Hyrtl states that the intestinal canal of *Lepidosiren paradoxa* is slightly S-shaped in the horizontal plane.

In *Ceratodus forsterii* and *Lepidosiren annectens* I found there was no indication of curvatures in the horizontal plane; but Parker states that he finds the gut in *L. annectens* slightly curved (S-shaped) in the VERTICAL plane, and hence that my statement that the alimentary tract in the Dipnoi is strictly parallel with the notochord is incorrect.

Even Parker's observations show the correctness of my statement, while he says, on page 215, "The alimentary canal extends almost in a straight line from the mouth to the vent," making no mention of curves.

The sensory papilla which I found projecting as a finger-shaped process part way across the anterior narial opening in *L. annectens*, Parker was unable to detect. No histological examination was made of this papilla, but I judged it to be tactile in function and from its location to serve as a guard to the entrance of the nasal chamber.

Our author does not produce any evidence for the support of his change in the name of the URINARY BLADDER to that of the CLOACAL CÆCUM, and he adds nothing to our knowledge of either its structures or its functions, so that any comparison of this organ with the rectal gland of Elasmobranchs is entirely against the known morphological relations of the two organs. The rectal gland of Elasmobranchs is a diverticulum of the gut in close relation with the end of the spiral valve, while the urinary bladder of the Dipnoi is a pocket of the cloaca entirely foreign to the gut, since it lies outside of the rectal sphincter and in close relation with the openings of the kidney ducts.

With regard to the LYMPHOID ORGAN of the mid-gut, which

was fully described in my paper, Parker thinks he has positive evidence that it is a spleen, and hence uses this designation throughout. The name was first applied to this structure by Klein. The term spleen in anatomy is used to designate a definite body of lymphoid tissue which is usually more or less closely connected with some part of the mid-gut, though it may lie in the mesentery far from the walls of the gut. The name is strictly morphological in its bearing, and does not carry with it the idea of specific and localized functions. So far as the mass forms a discrete body, the term spleen is appropriately applied to it, for it serves to definitely mark the mass, but when the mass is absent, or, in other words, when the tissue has other relations, e. g., as in the *Dipnoi* where it is inclosed WITHIN the wall of the gut, we not only do not gain in the accuracy of designation, but we detract from the definiteness of the name as applied to other forms.

In structure, these tissues are not to be distinguished from each other, and if the aggregation in the region of the mid-gut is to be called spleen, those in the hind-gut and fore-gut are likewise spleens. We avoid difficulties of nomenclature if we reserve the term spleen for a discrete mass of lymphoid tissue which lies in the mesentery outside of the walls of the mid-gut.

Professor Parker has done a great service in tracing out the extent of the pancreas which, in the *Dipnoi*, lies entirely within the walls of the gut between its two coats and which he has described in histological detail for the first time; but the discovery of the pancreas and its ducts was made by McDonnell in 1858. This investigator made observations on living material which was afterward used for dissections, and he clearly states that the pancreatic ducts empty into the mid-gut in company with the bile ducts. Melville added a note to McDonnell's paper to the effect that both spleen and pancreas were present in the organ which the latter called pancreas.

No one has yet pointed out the very great significance which the condition of the pancreas in *Lepidosiren* has from a comparative anatomical standpoint. It is by far the most primitive condition of the organ known for the VERTEBRATA, since it

remains entirely within the intestinal wall lying between the mucous membrane, of which it is an outgrowth, and the muscular coat of the gut and it thus represents a very early stage in the ontogeny of the organ as it is developed in other animals.

Professor Parker states that the spiral valve in *Lepidosiren annectens* makes 6 or 7 turns. I found in all the specimens studied, and the point was specially examined, that the number was uniformly eight.

Our author attributes the statement to me that *Lepidosiren* lacks a distinct muscular coat to its stomach, and that in the intestine the musculature is only slightly developed.

On page 491 of my "Beiträge" I state: "Sowohl bei *Ceratodus* als bei *Lepidosiren* sind die Wände des Vorderdarmes auffallend dünn. Bei der maceration traten zwei deutliche Lagen von Muskelzellen hervor. Sie repräsentiren die Längs- und die Ring muskulatur der höheren Wirbelthiere und sind sehr ähnlich der Muskelementen der Cyclostomen, etc."

The passage which Parker alighted upon to misconstrue by taking it away from its context, reads as follows: "Bei *Ceratodus* ist das Magenende veshältnissmässig viel weiter als bei *Lepidosiren* (italics inserted here). Eine deutliche Muskulatur fehlt, doch sind zahlreiche spindelförmige Muskelzellen durch das ganze Bindegewebe der submucosa zerstreut."

Parker states that he failed to find the lobulation of the kidneys in *Protopterus* as described by me for the older individuals. My observations were made on a specimen 42 cm. long. The lobules were well-marked, but not so numerous or so sharply defined as in *Ceratodus*. He concurs in my statement that the so-called male organs of writers previous to 1884, were, in all probability, only immature female organs. Parker describes the presence of two vibratile filaments in the spermatozoan of *Protopterus* and considers this condition unique among vertebrates. I have observed the same structure in ripe spermatozoan of *Rhinoptera bonasus*. My observations were made on July 13, 1889, at the Marine Biological Laboratory, and it was found that the apparently single-headed, double-tailed spermatozoan resolved itself into a simple, straight filament, possess-

ing a thickened body in the middle with a tapering filament given off from either end of it. The only difference between the two ends of the central body of the sperm-cell was the presence of the nucleus at one end from which the longer filament was given off. During life, both of these filaments are spirally but loosely coiled about one another, and during progressive motion this arrangement gives rise to the appearance of a vibratile membrane spirally placed on the tail. On adding Perenyi's fluid to the sperm, the cells, one and all, flew out straight and rigid, and the refractive body (nucleus?) became very distinct in each. I have observed this structure in other fish spermatozoa, but never so distinctly marked as in the cow-nosed skate. It is possible that the double tail of *Protopterus* will be found to be constructed after this plan.

Owing to the very great scarcity of specimens of *Lepidosiren paradoxa*, it may be of interest to many to have a list of the known examples with their present resting places.

The following is a table of all the South American specimens of *Lepidosiren* yet taken and recorded:

Specimen	Discovered by	Locality.	Size.	Condition.	Museum.
No. 1	Natterer	Borba on the R. Madeira, 1836.	3 ft. 9 in.	Dissected	Vienna
No. 2	Na terer	Villa Nova on the R. Madeira, 1836.	1 ft. 10 in.	Dissected	Vienna
No. 3	Unknown	Unknown, 1840.			Paris
No. 4	Castelnau	Ucayali River, 1847.		Dissected	Paris
No. 5 {	Dr J. Barbosa	Igrapé de Aterro, (Mauá), 1886.	in cm. 85, female	Whole	Florence, Italy.
No. 6	Rodriguez				
	Rodriguez	Autaz, Madeira River, '87	in cm. 40	Whole	Florence, Italy.

The fifth specimen was a female with well-developed eggs, which was caught in August, 1886. It was 85 cm. in length, and 28 cm. in girth at the pectoral appendages. The body is distinctly cylindrical in shape, but somewhat flattened on the abdominal surface where the scales are bigger, thicker and lighter in color. The tail is short and much compressed, and is provided with an irregularly-rounded caudal fin, which is not continued cephalad as a true median fin, but only as a slight keel to the middle of the back. The fin rays of the caudal portion are

cartilaginous. The pectorals and pelvic appendages lack a membranous edging. The pectorals are slender and compressed, while the pelvic appendages are stouter and conical in shape.

The scales are disposed in longitudinal rows, 10 in each, and are of a dark brownish purple color, with distinct blotches except on the belly. The lateral line is double. The eyes are small and lie beneath the skin. The branchial openings are very narrow, and are protected by thick fleshy flaps. External gills are absent, and the internal gills cannot be seen through the deep and narrow branchial slit. The mouth has fleshy lips. The gill-clefts are four in number, the fourth being much reduced. The three free branchial arches are fringed with conical papillae. The cloacal opening lies 10 mm. to the left of the median ventral line.

The sixth specimen comes from the same hands, and is in the Florence Natural History Museum.

It is much to be desired that these well-preserved specimens may become the means of clearing up many points in our account of the anatomy of the Dipneumonous Dipnoi.

² Jenaische Zeitschrift Bd. XI, 1885.

³ Schneider, A., Über die Flossen der Dipnoi und die Systematik von *Lepidosiren* und *Protopterus*, Zoologischer Anzeiger, No. 231, 1886.

⁴ Baur, G., *Lepidosiren paradoxa*. Zoologischer Jahrbücher, II, 1887.

⁵ The following notes on the statements given by different authors may be of interest in this connection:

Wiedersheim (Lehrbuch, p. 608) says *Protopterus* has 6 gill-bars and 5 gill-slits, with three and one-half gills.

Owen (Comp. Anat., p. 468-481, '82, '85, '86) gives the same number of gill-bars, but says that there are 2 biserial, and 1 uniserial gill, besides which there is the opercular gill attached to the membrane supported by the hyoid. That "three seemingly analogous filaments (i. e., analogous to the embryonic external gills of Elasmobranchs) are retained on each side for a longer period in *Lepidosiren annectens*, but lose their vascular and respiratory character before they are absorbed."

Parker gives (Trans. Roy. Irish. Acad., V. 30, pt. 3, p. 161) 5 gill-bars and 4 gill-clefts, exclusive of the spiracle or hyobranchial.

There is a difference of one gill-bar between Parker and all other observers. There is a further discrepancy among observers as to the number of gills. In the case of *Lepidosiren paradoxa*, Bischoff and Hyrtl disagree as to the number of hemibranchs, the former describing the same arrangement of gills for *paradoxa* as exists in *annectens*, but Hyrtl, who worked over the same specimens, says that the gill-plates are absent on

the first and last arches, only a trace of them being observable on the fifth. Since Hyrtl studied the material after Bischoff had dissected it, it seems probable that these gill filaments, being tender in nature, were broken away during the previous study, leaving only the "fadenförmigen Zötchen" found by Hyrtl.

⁶ Parker, W. N., Anat., Physiol. of *Protopterus*, Trans. Irish Acad., 1892.

⁷ Owen, R., Comp. Anat. Vertebrates and Description of *Lepidosiren annectens* Trans. Linn. Soc., XVII.

⁸ Giglioli, *Lepidosiren paradoxa*, Nature, 1892.

⁹ McDonnell, Anatomy and Physiology of *Lepidosiren annectens*, 1854.

¹⁰ Bischoff, Th. L., *Lepidosiren paradoxa*, Leipzig, 1840.

¹¹ Hyrtl, J., *Lepidosiren paradoxa*, 1845.

¹² Klein, Beiträge zur Anatomie d. *Lepidosiren annectens*, Jahrb. d. ver. f. Naturk. in Würt., 1864, XX.

¹³ Burekhardt, R., Das Nervensystem der Dipnoern (*Protopterus annectens*) 1892.

¹⁴ Wiedersheim Grundriss der vergl. Anat. 2te ed. 1893.

ANIMAL INTELLIGENCE.

BY JAS. WEIR, JR., M. D.

"Intelligence is a conservative principle, and will always direct effort and use into lines which will be beneficial to its possessor."¹ This definition of intelligence is peculiarly applicable to the lower animals, inasmuch as it does not convey any idea of a purely intellectual operation of the mind. Every instance of ratiocination in the lower animals, has its origin in the fundamental principle of benefit to the animal evincing this faculty of reason. The words, reason and intelligence, are, in a measure, synonymous, for without intelligence, reason can not exist and *vice versa*—without reason there can be no intelligence. They are both psychic factors, dependent each upon the other. The lower animals do not evince a high degree of intelligence, yet high enough to lift the mental operation above the automatic and spontaneous action generally called—instinct. Instinct itself is, in a certain sense, a process of intelligence, though its immediate operations may not be due to reason. Instinct involves mental operations; if it did not it would simply be reflex action. It is heredity under a special name. The father transmits his mental peculiarities as well as his corporeal individualities to his son. The experiences of thousands of years leave their imprint on the succeeding generations until deductions and conclusions drawn from these experiences become in man, that psychic essence called mind. The lower animals pass through a like experience and arrive, each in his own sphere and degree, at a kindred mental destination.

Reflex action is simply muscular adaptation excited by appropriate stimulation without mental cognizance. Instinct has always a mental element; and the lowest animal that lives is no more governed by reflex action than is man himself. The action of a spider spinning her web, is just as vol-

¹Cope: Origin of the Fittest, p. 40.

untary and is as much under mental direction and control, as the action of a carpenter building a house. That the very lowest forms of animal life give evidences of intelligence can no longer be denied. A very common rotifer whose body is cup-shaped and whose tail is armed with forceps, has been seen to seize a larger specimen with its forceps and thus attach itself to its cup. The larger rotifer immediately swung itself violently about until it met a piece of weed, this it seized with its forceps and began "the most extraordinary movements which were obviously directed toward ridding itself of its encumbrance." This it finally succeeded in doing, and the entire scene was so like intelligent action that the observer concludes "so that if we were to depend upon appearances alone, this one observation would be sufficient to induce me to attribute conscious determination to these microscopical organisms."² Conscious determination and ratiocination is found in animals as low down in the scale of animal life as the Rhizopoda. *Aethalia* will confine themselves to the water in a watch-glass in which they are placed, but when the glass is placed on sawdust, they will leave the water and go to the dust—their natural habitat.³ These rhizopoda are content to remain in the water, as long as there is no sawdust in their vicinity, but as soon as they recognize the sawdust *through the glass*, they crawl over the rim of the latter to get into a more pleasing abode. This is a wonderful example of conscious determination to be found in an organism so low in the scale of life. Once, while examining some fungal cells, Carter saw a still more wonderful instance of intelligence in a rhizopod. He noticed that one of the spore cells had ruptured and that grains of starch were escaping from the crevice. Suddenly an *actinophrys* came into the field of vision and proceeding to the ruptured cell seized a grain of starch and then retired to some distance. Presently it returned to the same cell and extracted another grain through the crevice. "All this was repeated several times showing that the *actinophrys* knew that those were nutritious grains, that they were contained in this cell,

²Romanes: Animal Intelligence, p. 18.

³H. J. Carter: Annals of Natural History.

and that, although each time after incepting a grain it went away to some distance, it knew how to find its way back to the cell again which furnished this nutriment."¹ Oysters taken from a bank never uncovered by the sea, open their shells, lose the water within and soon die; but oysters kept in a reservoir and occasionally left uncovered, learn to keep their shells closed and live much longer when taken out of the water.⁵ This is an act of intelligence due directly to experience without even the factor of heredity. It is an instance of almost immediate adaptation to surrounding circumstances. One would not expect to find examples of animal intelligence in such a low order as the *Helicidae*, yet several instances can be adduced where snails have not only shown ratiocination, but have also evinced love and affection.

A gentleman fixed a land-snail, with the mouth of the shell upward, in a chink of a rock. The animal protruded its foot to the utmost extent and, attaching it above, tried to pull the shell vertically in a straight line. Then it stretched its body to the right side, pulled, and failed to move the shell. It then stretched its foot to the left side, pulled with all its strength and released the shell. There were intervals of rest between these several attempts, during which, the snail remained quiescent.⁶ Thus we see that it exerted force in three directions, never twice in the same direction, which fact proves conscious determination and no slight degree of intelligence. An observer, Mr. Lonsdale, placed two snails in a small and badly kept garden. One of them was weak and poorly nourished, the other strong and well. The strong one disappeared and was traced by its slimy track over a wall into a neighboring garden where there was plenty of food. Mr. Lonsdale thought that it had deserted its mate, but it subsequently appeared and conducted its comrade over the wall into the bountiful food supply of the neighboring garden. It seemed to coax and assist its feeble companion when it lingered on the way.⁷ Here we see not only an example of memory and

¹Ibid.

⁵Dicquemase: *Journal de Physique*, Vol. XXVIII, p. 244.

⁶White: *A Londoner's walk to Edinburgh*, p. 155.

⁷Darwin: *Descent of Man*, pp. 262-3.

discrimination, but also of affection and solicitude. After the snail had made its voyage of discovery, with rare unselfishness and true affection, it remembered its sick mate and returned for it.

Beneath the pavement in front of my door, a wasp (*Vespa nigra*) has her nest. The entrance to this nest is at the bottom of a *sulcus* formed by two parallel bricks. I rolled a piece of paper into a compact wad and placed it between the bricks and over the entrance during her absence. When she returned she seized the paper with her jaws and forelegs and endeavored to pull it away. This was prevented by the interposition of the brick on which she stood. She then went to the other side and tried again. Here she failed for the same reason. She then descended into the little gully between the bricks and easily removed the wad. When she again left the nest, I replaced the paper, and on her return she went through the same performance as at first. Again I replaced it, but the *third time she went at once into the gully and removed the obstruction*. This she did three times in succession. Comment is hardly necessary. The evidences of memory and ratiocination are too patent to be denied. Some members of another family, distantly related to the *Helicidae*, the limpets, show evidences of intelligence, inasmuch as they have a very accurate memory of direction. Limpets, when at rest, live at certain fixed domiciles. When hungry, they leave these homes in search of food, but invariably return to them as soon as they have satisfied their hunger. One very pointed instance of this homing sense is given by Hawkshaw, a most careful and exact observer. A limpet had made a clearing on a sea weed covered block of chalk. In the center of this clearing was a pedestal of flint which projected an inch or more. On the top of this flint pedestal the limpet had taken up its abode. The cleared space had several hollows where the animal could have easily sheltered itself, but it preferred to return to its exposed home after each of its excursions.⁸

Not many years ago, a French exhibitor with a trained company of fleas passed through the country. These insects

⁸Hawkshaw: Journal Linn. Soc., Vol. XIV, p. 406.

had been taught to march and counter-march, to dance, to feign death, to pull miniature coaches, etc., etc. While this does not evince voluntary ratiocination, it shows that fleas think and are capable of receiving instruction. "When we consider the habits of ants, their social relations, their large communities, and elaborate habitations, their roadways, their possession of domestic animals, and even, in some cases, of slaves, it must be admitted that they have a fair claim to rank next to man in the scale of intelligence."⁹

When Lubbock says that the ant ranks next to man in the scale of intelligence he does not err. The superior intelligence of the ant has been recognized and commented on by man since the very inception of history. The wisest man of his day, King Solomon, uses the ant to point a moral. He considers her intelligence and industry worthy of emulation, and says to the sluggard: "Go to the ant, consider her ways and be wise." This one factor, intelligence, and the faculty of intercommunicating intelligently, makes a colony of ants a *perfect society*. Their social relations make it a model republic. Ants are true socialists; communists of an ideal type. Their's is a patriotism sublimely grand in its total self abnegation. The commonwealth is everything—individual weal is not considered. Man is susceptible to individual attachments which form the basis of his happiness. The affection of ants, on the contrary, is a patriotism that is extended to the whole community, "never distinguishing individuals, unless, as in the instance of the communal mother, connected with the furtherance of the common good."¹⁰ Ants can undoubtedly communicate. A short while ago I crushed a pismire in the track usually taken by the members of a colony inhabiting the hollow of a beech tree standing in my yard. A soldier ant came along presently and, smelling the blood of his murdered companion, was seized with a panic terror, and rushed away into the nest. He shortly returned with thirteen companions and made a slow and careful reconnoissance of the dead body and its surroundings. Then all of them examined

⁹Lubbock: *Ants, Bees, and Wasps*, p. 1.

¹⁰Kirby and Spence: *Entomology*—"Perfect Society."

the corpse, and, having satisfied themselves that their sister was dead, returned to the nest. In a few moments a large worker-ant, accompanied by two soldier ants, came out and proceeding to the body, picked it up and carried it down the tree to the ground. They then went beneath the grass and I lost sight of them. Their every action seemed to me to be governed by an almost human intelligence. The discoverer of the murder hurried into town, gave the alarm, and, quickly gathering some of his companions, went out in search of the murderer. On discovering that their companion was dead and her slayer absent, they came back to town and sent out a burial party.

The ant is the only animal except man, which has slaves and domestic animals. Their intelligence is so highly developed that they make a perfect success in rearing their cattle and in capturing their slaves. The cattle of the ants are of the order *Aphididæ*. The herdsmen of these aphidian cattle can be seen patrolling the shrubs on which the aphides are grazing. On them devolves the care of the herds. They bring them out in the morning and carry them back at night. They gather the eggs of the aphides, carry them into a specially built nursery, attend them carefully until the young aphides are hatched out, and then carry them to the shrubs most liked by them for food. Some strange sense enable them to recognize one another—an ant of the same species, but coming from another nest, is immediately recognized as a stranger and at once attacked. If the eggs of one ant colony are hatched out in another of the same species, the young ants are at once known to be strangers and intruders. This far transcends our intelligence. What mother could recognize her infant if it were born in the dark and she had never seen it? Again, if the *larvæ* of ants are removed, hatched outside of the nest, and then returned, the ants at once recognize them as kinsmen and receive them into the nest.¹¹ That ants and bees do communicate intelligently is no longer denied. Their means of communication is not defi-

¹¹Lubbock: *Ants, Bees, and Wasps*, p. 119, et. seq.

nately known, but it is the opinion of most scientists that it is through their antennæ.

I once saw wonderful evidences of this power of intelligent communication while watching a battle between *Lasius niger* and *Lasius flavus*. The black ants were on a foray; the booty in question being a large herd of aphides owned by the yellow ants. The yellow ants had a commissariat department and an ambulance corps. I frequently saw them drop to the rear during the battle and partake of refreshments. Those slightly wounded were also attended to by the ambulance corps. The black ants were in light marching order, and had neither of these conveniences and necessary adjuncts. These ants seemed to be governed by a high order of intelligence in this battle. The yellow ants repeatedly sent back to their village for reinforcements and in this instance were victorious. They were not so fortunate, however, in a second battle I witnessed, a short time afterward. Their antagonists were of the same species as in the first battle, but from a different colony. In this second battle the yellow ants were all slain, and their herds of aphides carried off by their conquerors.

The bee ranks next to the ant in point of intelligence and I have witnessed numerous instances of ratiocination in these interesting little animals. My bee-house is built of brick, without windows and has only one small door. The hives are made of glass and covered with thick curtains of muslin. This renders observation very easy. On one occasion I noticed that from some cause, a comb had become detached and was in danger of falling to the floor. The bees had noticed this before it had become apparent to me, and had begun to provide against disaster. They rapidly built a broad, thick support of wax between the endangered comb and the one next to it, thus securing it firmly. They then reattached the detached comb securely to the roof of the hive. When this had been done, they took away the temporary support and used the wax elsewhere. When men see a wall out of plumb and in danger of falling, they use like methods to prevent disaster. De Fravière says that bees have a number of tones which they emit from the stigmata of thorax and

abdomen and by which they communicate information.¹² When a bee arrives with important news she emits several shrill notes and taps a comrade with her antennæ; this comrade passes the news to another, this to another and so on throughout the hive. If the news is pleasing all remains orderly, but if the news presages danger, great excitement arises. The news of danger is always carried first to the queen as the most important person in the community.¹³ I have heard these tones and believe with De Fravière that bees communicate information in this way. The queen emits a tone which is different from those of the workers. When the queen makes a progress through the hive while laying eggs, she frequently emits this cry. As soon as the workers hear it, they bow their heads and remain quiescent for several seconds. Both ants and bees show great affection for their young. They feed and cleanse them and assist them in every way possible. The young ant is shown all of the devious pathways and corridors in the habitation by the older ants, and her first visit into the world is made with several chaperones.

There is a spider peculiar to this locality (Davies Co., Ky.) which I have never seen elsewhere and which I have not seen described. This spider spins two webs; one is a trap set for the procurement of her food, the other is built for the gratification of an æsthetic feeling hardly to be expected in an animal so low in the scale of animal life. This latter web is generally spun in the angle formed by two walls, and always where the early morning sun can shine on it for several hours. Through the center of the web, reaching from one extremity of its long diameter to the other, the spider spins a ribbon of silk about an inch broad. This ribbon is very beautiful. The mesh is as closely woven as silk itself, and shines in the sunlight like a band of silver. As soon as the sunlight falls upon this web, the spider makes her appearance and walks slowly up and down her glittering roadway. She is not at all timid and I have watched her for hours at her strange performance. She irresistibly reminded me of some well dressed woman who

¹²Romanes: *Animal Intelligence*, p. 158.

¹³*Ibid.*

was out for a morning walk. She never left this ribbon to secure food, though I tempted her frequently with insects. After an hour or two of promenading, she would leave this web and go to her trap-web, which is generally situated near her place of amusement. This she kept up day after day until the duties of maternity called her elsewhere. I have never seen the male. There is but one other instance in the animal kingdom where an animal builds a special place of amusement. That animal is the bower bird, of which mention will be made further on.

Curiosity is largely developed in birds. The blue jay is the most curious as well as the most voluble of all birds. I have been able to differentiate twenty-three distinct utterances in the language, if I may use the word, of the jay. On one occasion, I left a glass jar containing three newts, on a large block of sandstone in my front yard. It had not been there long before a jay flew down to examine it. One of the newts made a quick motion, and uttering a cry of surprise the jay flew to a tree overhead. He remained quiet for an instant, as if in profound thought. He then uttered his assembly call and birds of all kinds came hurriedly flying up in answer to it. In a few moments I noticed in the surroundings trees, jay-birds, wood-peckers, sap-suckers, cat birds, song sparrows, orioles, mocking-birds, blackbirds, pee-wees and flickers. They made a terrible outcry, but suddenly became silent, when the jay, which had called them together, flew down to the rock. Several of his most courageous brethren immediately followed him. He went up to the jar, and made a careful examination of it and its contents, all the while uttering a low querulous monologue. Suddenly he uttered three loud, peculiar cries and flew away. The assembly then dispersed. On another occasion I noticed a jay sitting silent and absorbed on the roof-tree of a grape arbor. He appeared to be watching something beneath him very intently. On focusing him in my glasses, I discovered that he was in a state of great excitement and trembling all over. I noticed the direction of his gaze and soon saw the object of his regard. A large male cat was stalking a hare and was just crouching to make his spring. He sprang

at the hare, but his jump fell short, and the hare bounded away in safety. And then the jay-bird seemed to be fairly overcome with delight. He trounced himself up and down, screaming with sarcastic laughter. He seemed to be jeering and ridiculing the cat to his fullest extent, and the cat seemed to understand him. He dropped his tail and disappeared in the bushes. The jay uttered one last note of derision and then flew away.

I once saw a very young cockerel come up behind an elderly hen and suddenly embrace her. When she discovered the youth of her assailant, her surprise, indignation and wrath was perfectly apparent and very laughable. Birds show a distinct individuality in nest building. No two pair of birds, even of the same species, build nests alike. To the casual observer they appear alike, but to the careful and experienced nest hunter, there is a marked originality in each nest. The general forms are the same, but each pair of architects leave the impress of individual genius on their particular nest. Three pairs of cardinals have been nesting in my garden for several years. If shown the nest, I can tell the pair of birds which built it. Wallace gives an instance of original nest building. Several pairs of bullfinches were taken to Australia when quite young. When they came to build their nests, they built them totally unlike those of the English bullfinch. They were long and round, like those of the oriole, only the entrance was at the bottom.¹⁴ Some birds have developed æsthetic feeling and have a well marked love for the beautiful. Certain humming birds decorate their nests with beautiful pieces of lichen which they fasten on the outside. Feathers and various colored mosses are used for the same purpose.¹⁵ Darwin asserts that the curious structures of the bower birds are pleasure houses, built by the birds for their own amusement and sports.¹⁶ These bowers are not nests and are never continuously occupied by the birds. The nests are built in the jungle some distance from the bowers. The birds

¹⁴A. R. Wallace: *Darwinism*.

¹⁵Gould: *Birds of Australia*, Vol. I, p. 442.

¹⁶Darwin: *Descent of Man*, pp. 92, 406.

first build a platform of sticks and twigs, all of the knots and short twigs being turned toward the ground, thus giving a perfectly smooth floor. The bower, an oblong, oval structure, open at both ends, is then erected on this platform. This is also made of twigs, with all projections turned outward. The entrance to this bower is decorated with feathers, bones, shells, mosses and, in fact, any gaily colored article which the bird can procure. Evidences of intelligence in the higher orders of animals are so patent that even the most casual and superficial observer can see them. The cat, the horse, and the dog are nearer to man in his daily life than any other animal, and instances of their intelligence are very numerous.

I present here a letter of Mr. J. Gibson Taylor, Owensboro, Ky., in which he relates a remarkable instance of ratiocination in a dog. "The dog, a water spaniel, had gone after a stick flung upon the ice of a pond about twenty feet distant from shore. The water was about five feet deep. The ice gave way. The dog went under the water several times in swimming about the enlarged space made by attempting to regain the surface of the ice, which gave way under his weight. He became thoroughly chilled by much confused swimming about in a circle, seeking some point at which the ice would bear his weight. I reached a limb to him and calling him by name shortly got his attention. He placed his paws upon the ice and seemed to listen intently as I extended the limb toward him, the ice, meanwhile, sinking under his weight as he looked at me. He caught the limb between his teeth and I assisted him by pulling him toward me upon the thicker ice inshore. Finally the ice became strong enough, about 15 feet from shore to sustain his weight. So, still with his teeth locked on the stick, I pulled him on the thicker ice and across the surface to the shore."

Here the dog, fully seeing his danger, and understanding the purport of the stick thrust out to him by his master, grasped it with his teeth, and held on until he was dragged into safety. Could man do more or reason better?

NOTES ON A COLLECTION OF MOLLUSKS FROM
NORTH WESTERN LOUISIANA, AND HAR-
RISON COUNTY, TEXAS.

BY T. WAYLAND VAUGHAN.

INTRODUCTORY REMARKS.

For several years, while resident in Louisiana, I busied myself in trying to bring together as good a local collection of the mollusks of the region as possible. During the past summer, while at work on the *Louisiana Geological Survey*, I continued my collecting, obtaining many specimens of land-shells, and a few fresh-water shells. Through the kindness of Mr. George Williamson, of Grand Cone, La., of Mr. O. B. Lewis, of Burk Place, and Messrs J. D. and J. E. Bailey, of Summerfield, coupled with my own efforts, it is likely that I have obtained more species from this section than anyone else. In view of this it seems highly probable that a few notes on this collection would be of passing interest to conchologists.

The largest part of the section that these remarks apply to is included between Ouachita River on the east, a line through Alexandria on the south, and the Texas and Arkansas lines, but I have transgressed these lines in speaking of a few specimens collected to the south of it in St. Landry Parish, and have included in the discussion, as the title denotes, Harrison County, Texas.

This list undoubtedly does not contain all of the species found in this region, for a few species originally described from this section have not been rediscovered. Undoubtedly, many more species of *Cyrenidæ*, *Pupidæ*, and other families will be found later. It is worthy of notice that the collecting of my friends and myself have brought to light no species of that large family *Pleuroceridæ* (*Strepomatidæ*) that is found in such large numbers in the southern States east of the Mississippi River. Some species of this family have been noted from Louisiana.

In the identification of my species I have to acknowledge gratefully the assistance of Messrs Wm. H. Dall, Chas. T. Simpson, Wm. A. Marsh A. A. Hinckley, R. E. Call, and Dr. V. Sterki. Either Mr. Simpson or Mr. Marsh, or both, have examined specimens of most of my *Unionidæ*, and Dr. V. Sterki has examined nearly all of my *Pupidæ*. It has been my good fortune to examine a good many of Lea's and Conrad's types at the Smithsonian Institution and at Philadelphia Academy of Natural Sciences, and I have been able to use the works found in the library of the Museum of Comparative Zoology at Harvard University, so that I think most, if not all, of the identifications are entirely trustworthy.

To my friends who have aided me in collecting, and to those who have helped in the matter of identification, my sincere thanks are extended. To Dr. Otto Lerch, Geologist of Louisiana, my thanks are especially due for enabling me to do collecting throughout the summer.

NOTES ON THE TOPOGRAPHY AND CLIMATE OF NORTHWEST
LOUISIANA.

In order that the physical surroundings of the mollusks herein noted may be better understood, it appears to be justifiable that a few notes on the topography and climate of the section will be in place.

Probably there is no portion of the United States so misunderstood from a topographic standpoint as northwest Louisiana. Most of the people who visit the state go to New Orleans, which stands from eleven to forty feet above the sea level, in almost the flattest portion of the inhabitable part of the State, and immediately jump to the conclusion that the whole State a jungle of swamps and alligators. It is undeniable that a large portion of the State stands very little above mean tide-water, and that swamps and alligators do abound, but the northwestern portion of Louisiana is moderately hilly. The mean level of the country, from Shreveport to Monroe, is about 400 feet above the sea level, the elevation reaching on the hills from 150 to 300 feet higher. If one starts at Shreveport, which is between 198 and 227 feet above the sea, and goes to Monroe,

he will, after passing out of flat river bottom, cross a strip of level country about ten to fifteen miles wide, that forms a kind of shelf alongside the river bottom. After this one goes into the hills—topped with red-sandy clay, red-sandy or red-clay soils. These hills are the products of erosion out of a past plain, and Mr. L. C. Johnson compares them to the buttes of the west. Some of them rise rather abruptly, others gently; some attaining a height of from 80 to 150 feet above the general level of the hill lands. One hill called Leatherman's Mountain, is said by Mr. Johnson to reach an elevation of 700 feet, or about three hundred feet above the general level. The vegetation of these hill lands is mostly oaks, where the soil is not very sandy, but when much sand is present, the short-leaf pine (*Pinus mitis*) abounds.

As one proceeds south from Arcadia, at something like thirty miles distant from that place, the red sandy clays give place to pure white sands, that bear luxuriant forests of the long leaf pine (*Pinus palustris*), though as one nears Alexandria, which is 85 miles further south than Arcadia, the sand is somewhat redder, but still contains little or no clay. In the country whose surface is made up of these deep white sands, the lands wash badly, and hills rise very steeply to a height of 75 to 100 feet above their bases. These sandy hills are all clothed with an almost uninterrupted forest of that most majestic tree, the long leaf pine. It is absent only in the small "hollows" between the hills, and in the calcareous prairie lands.

Scattered through the southern part of Bienville Parish, through Winn, Grant, and Catahoula Parishes, are spots of calcareous lands, that are usually prairies of several acres in extent. These lands usually belong to the Jackson and Vicksburg horizons, though the spot of the lime-lands in northern Natchitoches Parish belongs to the Claiborne, *Ostrea sellaformis* being found there in great abundance. There is a hill of crystalline limestone near Winfield, La., that is Cretaceous. These lime-lands seem to present especially good conditions for the development of the land shells. By far the majority of the species of the land shells collected were found associated at one place or another with these calcareous lands. The need of lime

for the growth of the shells easily accounts for this. *Bulimulus dealbatus* and *Helicina orbiculata* were found in abundance only on these soils.

All of the chief streams, large bayous, as well as rivers, flow in a general southerly direction. The two main streams are Red River and Ouachita River. "A dividing ridge, frequently noticeable only on closest inspection, runs almost central between the rivers, dividing the Ouachita and Red River system eastward and westward" (Lerch). Thus, certain of the bayous flow into Ouachita River, such as Cypress and Corney, and others flow into Red River, such as Dorcheat, Black Lake Bayou, Bayou Bodeau, etc. Bayou Pierre is on the west side of Red River.

One of the most noteworthy things about these streams is that they are subject to great periodical overflows. Thus, in the summer of 1891, I remember rolling up my trousers to my knees and wading across Bayou Dorcheat, but in the spring of the following year, when Red River was so overflowed as to wash away much of the railroad track, steamboats took passengers down the Dorcheat and up Red River to Shreveport.

Another feature of Red River is the flat, basin-like reservoirs, called lakes, that are found on either side of it. In many cases it is impossible to find any banks to these lakes, so gradually does the land slope toward them. There is a stream always flowing through the middle of them, and, in consequence of an insufficient outlet, the water accumulates at the lower portion of the stream. The high water in these lakes is caused either by back-water from the river, or by a large amount of water being brought by the stream that opens into them.

The bottoms or beds of these lakes and bayous are usually very soft, and collecting is thus rendered abominable, it often being a continuous process of wallowing in the mud. Sometimes a firm foundation may be found to stand on, but it is the exception. In Red River one usually sinks waist-deep in the soft mud. The bottom of the smaller creeks is usually somewhat firm. The small creeks in the sandy hills of the long leaf pine region have beautiful, firm, white sand bottoms, and

the water is so clear that the fishes can be seen darting hither and thither, even when they are of considerable depth.

As to climate, the following data taken from Dr. Otto Lerch's "Preliminary Report upon the Geology of the Hills of Louisiana, etc." (1892), may be of interest.

Mean Temperature at Shreveport, La., for each Month the past Twenty Years, from 1871 to 1890, inclusive.

Jan.	Feb.	Mar.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Annual mean.
45.8	51.5	58.1	66.1	73.3	79.9	82.7	81.5	74.8	65.4	54.2	49.5	65.2

The latest frost in the spring ranges from Feb. 14 to April 9; it usually occurs the latter part of March or within the first few days of April. The earliest frost ranges from October 7 to November 18—it usually comes toward the latter part of October. The highest temperature in the summer ranges from 91° F. to 107° F.; ordinarily it is between 98° F. and 104° F. In winter the temperature rarely falls below 12° F.

Total Precipitation at Shreveport, La. Average of each Month the past Twenty Years, from 1871 to 1890, inclusive.

Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Annual mean.
4.93	4.62	4.74	5.55	4.47	3.69	3.74	2.05	4.30	3.52	4.88	4.81	4.30

As one goes south and nearer the seashore from Shreveport, corresponding changes in the temperature, etc., take place.

LAND MOLLUSKS.

LIMACIDÆ.

ZONITES.

Zonites (Hyalina) arboreus Say, extremely abundant, being found under damp rubbish throughout the section.

Zonites (Hyalina) indentatus Say, is not so abundant as the preceding species, but is found almost everywhere the conditions of snail life are satisfied.

Zonites (Hyalina) minisculus Binney, is found rather commonly throughout the section.

Zonites (Conulus) Sterkii Dall, was collected under damp leaves near Mt. Lebanon.

Zonites (Conulus) fulvus Draparnaud, is found in many places, but is not very abundant.

Zonites (Mesomphix) laevigatus Pfeiffer, is found in many localities, and was collected in abundance in trash found near branches and along the creek bottoms.

Zonites (Mesomphix) demissus Binn., was collected at several places in Bienville Parish, at Grand Cane, and on the calcareous prairies of Winn Parish. Not very abundant.

Zonites (Mesomphix) intertextus Binney, abundant under trash along creek bottoms. The specimens are usually more depressed than the figure in W. G. Binney's Bulletin 28 of the U. S. Nat. Mus., but the specimens collected in Red River bottom in Rapides Parish were quite as much elevated.

LIMAX.

Limax, sp. A species of *Limax*, that seems to be *L. campestris* Binney, was collected in the early part of 1891 abundantly around Mt. Lebanon after light showers. The extremely dry summer of '91 seemed to have almost exterminated them, so that after that spring I could not find any more specimens, and did not determine the species certainly.

Limax flavus Linn. was collected under some logs near the depot at Washington, St. Landry Parish.

PHILOMYCIDAE.

PHILOMYCUS.

Philomycus carolinensis Bosc. Abundant in damp places.

HELICIDÆ.

PATULA.

Patula alternata Say, abundant throughout the section.

Patula perspectiva Say, was collected at Columbia, near Rosefield, in Catahoula Parish, and near Ville Platte, in St. Landry Parish. Is not very abundant.

PUNCTUM.

Punctum pygmaeum Draparnaud, near Mt. Lebanon. Rare. Dr. Sterki considered a specimen that I sent him this species.

HELICODISCUS.

Helicodiscus lineatus Say, found in many localities. Not very abundant.

POLYGYRA.

Polygyra leporina Gould, found in many localities in small numbers.

Polygyra texasiana Moricand, found near Tullos, La., in calcareous prairie, and in the Red River drift at Shreveport and Alexandria.

Polygyra dorfeuilliana Lea, abundant at Mt. Lebanon, and is found in many other places.

Polygyra espiloca Rav. A single specimen was collected on Catahoula Prairie, and some others were found near Ville Platte.

STENOTREMA.

Stenotrema monodon Rackett, var. *fraternum* Say, found in abundance throughout the section. The variation in size, and degree of compression of the spine is great.

Stenotrema labrosum Bland, calcareous prairie at Tullos, and in the Red River drift at Alexandria.

TRIODOPSIS.

Triodopsis inflecta Say, was collected in a good many places, but is not very abundant.

Triodopsis obstricta Say. I have collected specimens in the river drift at Alexandria and Shreveport. At Alexandria I also found some live specimens. Mr. Geo. Williamson has found the species rather abundant around Grand Cane.

Triodopsis vultuosa Gould, found abundantly around Mt. Lebanon, and in many other localities.

MESODON.

Mesodon thyroides Say. Both the more typical *thyroides* and Gould's variety *bucculentus* are abundant at many localities.

Mesodon albolabris Say. Some specimens, though somewhat small, for this species seem best placed when referred to it. Not abundant.

Mesodon divestus Gould. Grand Cane, La. These specimens do not fit anything else, and Mr. Harper, of Cincinnati, has so determined specimens sent him by Mr. Williamson. Since we are agreed independently, I feel safe in the identification.

BULIMULUS.

Bulimulus dealbatus Say, found by the thousands on the calcareous prairies of Winn and Catahoula Parishes. Mr. Lewis collected it around Burk Place, Bienville Parish.

PUPIDÆ.

STROBILA.

Strobila labyrinthica Say, abundant wherever there is damp trash.

PUPA.

Pupa curvidens Gould, Mt. Lebanon, La., and near Bienville, also from river drift at Alexandria.

Pupa pentodon Say, river drift at Alexandria.

Pupa milium Gould, river drift at Alexandria.

Pupa sp. Calcareous prairie lands, Winn Parish, La.

Pupa fallax Say, found in nearly every portion of the section. Often very abundant.

Pupa armifera Say, throughout the section, but not so abundant as *P. fallax*.

Pupa contracta Say, throughout the section. Abundant.

Pupa procera Gould, rather abundant on the calcareous prairie lands of Winn Parish, found also in the Red River drift at Alexandria.

VERTIGO.

Vertigo ovata Say, river drift at Alexandria.

SUCCINEIDÆ.

SUCCINEA.

Succinea avara Say, Mt. Lebanon ; calcareous prairie lands of Winn Parish. On these lime prairies dead specimens are found several inches beneath the surface of the ground. I imagine that they crawl into cracks in the ground during the dry summer months and are entombed.

Succinea grovesnorii Lea, Jonesville, Texas ; Boyce, La., and Bayou Pierre. These specimens are obtained in the damp rubbish immediately above the water's edge. They seem almost semi-aquatic.

HELICINIDÆ.

HELICINA.

Helicina orbiculata Say, found by the thousands on the calcareous prairies of Bienville, Winn and Catahoula Parishes, and very abundantly in the river drift at Shreveport. This species has a well-established reputation for its variability, and in Louisiana its reputation is well-sustained.

FRESH-WATER SHELLS.

AURICULIDÆ.

CARYCHIUM.

Carychium exiguum Say, found in the damp leaves on the borders of many streams. This form could more appropriately be considered a land shell.

LIMNÆIDÆ.

LIMNÆA.

Limnæa columella Say, abundant in the ponds near Burk Place, La.

Limnæa humilis Say, Bayou Pierre, and Boyce, La.

PLANORBIS.

Planorbis trivolvis Say, var. *lentus* Say, abundant throughout the section.

Planorbis dilatatus Gould, found in nearly all of the smaller streams.

Planorbis bicarinatus Say, in the ponds around Burk Place.

ANCYLUS.

Ancylus obscurus Haldeman, found in nearly all of the smaller streams throughout the section.

PHYSIDÆ.

PHYSA.

Physa heterostrophæ Say, found in all of the streams and ponds throughout the section.

PALUDINIDÆ.

CAMPELOMA.

Campelema decisa Say, is as general in occurrence as *Physa heterostrophæ*. The form called *C. coarctata* by Anthony is found abundantly in many localities. This species is extremely variable, but the forms intergrade too well to separate them into several species.

VIVIPARA.

Vivipara subpurpurea Say, found abundantly in nearly all of the larger streams and lakes. The specimens show great variation, but are too well known to conchologists to need special notice.

Vivipara intertexta Say, Flagon Bayou, Rapides Parish, Lake Satt, pond near Jonesville, Texas. I have specimens from three other localities in Louisiana, showing that the species is widely distributed in the State, but I have never obtained it in large numbers, so it would be considered scarce.

HYDROBIIDÆ.

AMNICOLA.

Amnicola cincinnatiensis Anthony, Bayous in Claiborne Parish, and Lake Bisteneau. It is extremely abundant in Lake Bisteneau.

Ammicola sayana Anthony, Cross Lake at Shreveport. Not very abundant.

UNIONID.E.

UNIO.

Unio anodontoides Lea, is extremely abundant in many of the bayous and lakes. It was collected in Cross Lake, Caddo Lake, Red River at Shreveport, Lake Bisteneau, Corney Bayou, Bayou Pierre, etc. It was found most abundantly in Lake Bisteneau, the species from Red River at Shreveport were the most perfect. Although this species exhibits some variation in size and relative thickness of the shell, the variation is rather slight when compared to the great amount of some other species.

Unio gracilis Barnes, is not very abundant. In Caddo Lake a fine lot of young specimens were collected. It was also found in Cross Lake, Red River (at Shreveport), Dorcheat Bayou, Corney Bayou, Bayou Pierre, and Lake Bisteneau.

Unio purpuratus Lam. This handsome *Unio* is rather abundant. It was collected in Cypress Bayou (Texas), Caddo Lake, Cross Lake, Corney Bayou, Dorcheat Bayou, Bayou Pierre and Lake Bisteneau. The most perfect specimens were in Caddo Lake; here a considerable number of perfect young were obtained. The largest specimen was a dead valve from Dorcheat Bayou, it being about six inches in length. A large number of specimens were collected from little pockets that had been formed alongside Corney Bayou. The characters of this species are very constant.

Unio levissimus Lea, Caddo Lake, Red River at Shreveport. Rather rare. Some beautiful young were obtained in Caddo Lake.

Unio nigerrinus Lea. Localities: Corney Bayou, Cypress Bayou, La., Dorcheat Bayou and creek near Rosefield. This species is rather abundant. The largest specimens were obtained from Dorcheat Bayou, where the shells, besides being larger than those of the neighboring streams, have thick, somewhat massive, shells.

Unio haleianus Lea. A single specimen was collected by Mr. O. B. Lewis, at Burk Place, in a small creek. I collected a

specimen in Castor Bayou, Catahoula Parish, that I take to be of the same species.

Unio mississippiensis Conrad, is abundant in the ponds and creeks throughout the section. It was found in Dorcheat Bayou and in Bayou Pierre, but is usually not abundant in the larger streams. The species does not present very much variation.

Unio hydianus Lea, is found in all of the larger bayous in which I collected—Dorcheat, Corney, etc. The specimens are very numerous. The variation is great, from individuals that are sub-compressed, to those that are very much inflated. There is a marked tendency to become much inflated in old age forms. The number and size of the rays vary much, some specimens have wide rays, others narrow rays, and still others are scarcely rayed at all. This species, on account of its enormous amount of variation, is one of our most attractive and instructive forms.

Unio approximatus Lea. A specimen of this species was found in a small creek in Rapides Parish. We think that we are not alone when we consider the difference between *hydianus* and *approximatus* almost nominal.

Unio obtusus Lea, was collected by Mr. O. B. Lewis in a branch near Burk Place, in Bienville Parish. Mr. C. T. Simpson so determines a specimen that I sent him, and from Lea's figures and descriptions I would so consider it.

Unio parvus Barnes, is found in a good many of the bayous. It is almost impossible, if not entirely so, to separate this and the three following species, but a good many of my specimens seem undoubtedly *parvus*.

Unio texasensis Lea, abundant everywhere that I collected *Unionidae*, except in Red River, Cross Lake, and a few very small creeks. These specimens can be gathered by thousands. The variation is enormous, from elongated to rather short; from thin to rather thick shelled, etc.

Unio bairdianus Lea, is considered a synonym of the above. It is abundant in the creeks of the section.

Unio bealei Lea, were collected in the creeks around Mt. Lebanon. This form is extremely close to *texasensis*.

Unio camptodon Say, is found abundantly in the smaller streams throughout northwestern Louisiana. It seems to thrive best in small creeks and brooks that flow moderately rapidly, and have sandy bottoms. This species is so very abundant that, possibly excepting *Unio texasensis*, we are inclined to call it the most abundant species. Its range of variation is extremely great, and from the large suites that we obtained of it and the three following species, it seemed to us that we could trace their intergradation.

Unio declivis Say. Corney and Cypress Bayous in Claiborne Parish, near Mt. Lebanon, and near Jonesville, Texas. Mr. Williamson sent me a specimen with pink nacre.

Unio symmetricus Lea, in the creeks and bayous near Grand Cane. I have a good many specimens through the courtesy of Mr. Geo. Williamson, of Grand Cane. This species and *jamesianus* are, without doubt, synonyms, though a typical *symmetricus* can be distinguished from a typical *jamesianus*. I have seen Lea's types at the U. S. National Museum, and believe these to be pretty typical.

Unio jamesianus Lea, is abundant in the brooks and small creeks around Jonesville, and Port Caddo in Texas. Its habits closely resemble those of *camptodon*, with which it seems to connect by intermediate forms.

Unio lachrymosus Lea, is one of the most abundant of the species found in the section. Specimens were collected in Lake Bisteneau, Caddo and Cross Lakes, and in Bayous Dorcheat and Corney. The specimens are found in large numbers. The amount of variation is considerable, some specimens having a great number of pustules, while others have relatively few. Some specimens are much more compressed than others. The largest and heaviest specimens were from Caddo Lake.

Unio asper Lea, Corney Bayou, is found in other localities most likely; shows some variation in the number of pustules.

Unio pustulosus Lea, is not very abundant. Is found in most of the lakes and principal bayous. It is most abundant in Dorcheat Bayou. The specimens from this place are somewhat more inflated than most of the specimens that I have seen from the more northern States. Some of the variations

of *pustulosus* approach very near to *turgidus*, and I am inclined to the opinion that these two forms connect by intermediate examples.

Unio schoolcraftii Lea. Corney Bayou. Not very abundant.

Unio nodiferus Conrad. Corney Bayou. Not very abundant. These specimens seem almost fac-similes of those in the Philadelphia Academy of Natural Sciences collection from Neches River, Texas.

Unio turgidus Lea. Dorcheat Bayou. Somewhat abundant in this stream.

Unio pustulatus Lea. Caddo and Cross Lakes, Lake Bisteneau. It is abundant in the two first lakes. It varies very much in the amount of the development of the pustules.

Unio houstonensis Lea, is found in the three larger lakes and Bayou Pierre.

Unio trigonus Lea. Cross Lake, Bayou Pierre and Dorcheat Bayou. This species and the next two form a most interesting and a somewhat perplexing set of forms.

Unio cerinus Conrad, is found abundantly in nearly all of the bayous and the larger creeks throughout northwestern Louisiana. Many hundreds of specimens were obtained from Corney Bayou. It varies enormously, and undoubtedly grades into the next species.

Unio chunii Lea. Corney Bayou, Dorcheat Bayou, Cross Lake. It is somewhat abundant in Corney Bayou. It varies greatly, sometimes being arcuate on the base, almost hooked as the posterior margin is approached. The sharpness of the posterior ridge from the umbo varies much, as does the amount of inflation of the valves, forming, it seems to me, perfect gradations into *cerinus*.

Unio cuneus Conrad. Corney Bayou. Rare.

Unio cornutus Barnes. Caddo Lake, Cross Lake, Bayou Pierre. Not very abundant, and very constant in its characters.

Unio castaneus Lea. Corney Bayou, Cypress Bayou, Dorcheat Bayou. It is very abundant in these streams. The specimens from the two first are very small and somewhat compressed; those from Dorcheat are the largest that I have ever

seen. These latter specimens are much thickened anteriorly are much inflated in that portion, but are compressed posteriorly. The male individuals are rather pointed behind, and the females are truncated.

Unio elegans Lea. Caddo Lake, Cross Lake, Corney Bayou, and Bayou Pierre. Very scarce.

Unio donaciformis Lea, in the larger Lakes and Bayou Pierre. Very scarce.

Unio plicatus Lea. Bayou Pierre. Mr. Williamson sent me the only specimens that seem to me undoubtedly this species.

Unio perplicatus Con. Ouachita River, Bayou Pierre.

Unio multiplicatus Lea. Caddo Lake, Cross Lake, Dorcheat Bayou, Bayou Pierre. The finest specimens were from Cross Lake, near Shreveport. These would rival some of the monsters from Spoon River, Ill., and seem entitled to the name *heros*.

Unio undulatus Barnes, Bayou Pierre. Mr. Williamson has sent me some specimens that seem best placed under this species, though they could, without especial violence, be called *multiplicatus*.

Unio boykinianus? Lea. Dorcheat Bayou. I collected one specimen that has been so identified by Mr. A. A. Hinckley. I have seen specimens of the species in the Philadelphia Academy, and have looked up Lea's figure, and think that my friend is about as nearly right as can be in some of these delicate matters.

Unio trapezoides Lea, abundant in the larger lakes and bayous. I have also received specimens from the Ouachita River in Union Parish. In Caddo Lake this species is the most abundant. I collected many hundreds there. Some of the largest specimens, however, were from Cross Lake. This species seems to like the larger bodies of water where it has a considerable extent of rather level bottom of somewhat soft mud to dwell in. The characters of this species are, in the main, rather constant. The amount of inflation varies a good deal, as also does the postero-basal angle in sharpness; and the posterior ridge from dorsal to basal margins varies in its acuteness. There is a considerable variation in the distinctness of the folds, but the trapezoidal outline, the black epidermis, the

purple nacre remain constant, the variations being of essentially one type of structure.

Unio tuberculatus Lea. Corney Bayou, Dorcheat Bayou, Bayou Pierre, Cross Lake. It is rather abundant in the two first localities. Some of the specimens from Corney Bayou had the posterior portion very much elongated. Both the purple-nacred and white-nacred varieties were found.

Unio gibbosus Barnes. Corney Bayou. A small, compressed variety was found in great abundance in this stream.

Unio rotundatus Lamarck. Cross Lake, Bayou Pierre. This species is rather rare in Cross Lake, but, judging from the number sent me by Mr. Williamson from Bayou Pierre, it must be very abundant there. It is found abundantly in southern Louisiana. It appears that when northern Louisiana is reached, the northern extension of the species is being approached. A specimen of this species was collected on the border of Cross Lake, September 26, 1891, supposed to be dead. It was laid upon my table to await a convenient opportunity for washing and putting away. On November 18, I tried to prize the valves open, but they would not yield. The animal was cut out, and its heart was seen to be still beating. The mussel had lived almost two months on my table, out of the water.

MARGARITANA.

Margaritana confragosa Say. Caddo Lake, Lake Bisteneau, Cross Lake, Corney Bayou, Bayou Pierre. The species is rare everywhere, but is most abundant in Caddo Lake, where I collected about one dozen specimens.

Margaritana complanata Barnes. Corney Bayou. Rare. Out of a great many thousand specimens of *Unionidæ* from Corney, I obtained only two of this species.

ANODONTA.

Anodonta tetragona Lea. Dorcheat and Corney Bayous. Not abundant.

Anodonta stewartiana Lea. Lake Bisteneau and in a pond near Jonesville, Texas. Rare.

Anodonta gigantia Lea. Pond near Shreveport, and in a pond in Claiborne Parish. Near Shreveport, in a sequestered pond, into whose surface the sunbeams filtered through the willows, I made a rich "find" of a bushel of these *Anodontas*. They were the most beautiful specimens of the genus that I have seen, many being a most beautiful but subdued green—all as thin as egg-shells.

Anodonta corpulenta Cooper. Caddo Lake, pond near Shreveport, Bayou Pierre. Not abundant. This *Anodonta*, with the two mentioned just above, have a wonderfully close resemblance, and I would not like to undertake to never get them mixed up. I am inclined to believe that they are *naturally* mixed up, and that it is *artificial* to try to draw sharp lines between them.

Anodonta opaca Lea. Cypress Bayou, Black Lake Bayou, Corney Bayou, ponds around Jonesville, Texas; around Grand Cane; and I have received some good specimens from southern Arkansas. The finest specimens were from Jonesville, some being about six inches long, and with an epidermis of a beautiful polished mahogany color. This is by far the most common of the *Anodontas* in the section. At one time I had two hundred and fifty specimens from *one* bayou. The variation is enormous. The color is from mahogany to green, the form may vary from an elongated oval to a short oval, or the base may be arcuate, the size may vary in what appears to be adult specimens from two to five inches. Yet in spite of all this variation with a good suite of specimens, one readily sees that it is all the same species, for every intermediate form exists.

Anodonta suborbiculata Say. Caddo Lake. Very rare. This is such a handsome species that one wishes it could be found wherever he collects, but he is disappointed in Louisiana. In Caddo Lake a few small specimens are found.

CYRENIDÆ.

PISIDIUM.

Pisidium variable Prime, found in many of the small branches. Near Port Caddo, Texas, not far from Cypress Bayou, small peat mosses have formed between the bases of

some of the hills. These mosses are fed by springs. In small holes over this moss hundreds of this *Pisidium* can be collected by pulling up the moss and other aquatic or semi-aquatic plants and examining their roots.

SPHÆRIUM.

Sphærium contractum Prime, in the ponds and creeks around Jonesville, Texas, and in Cross Lake, near Shreveport.

Sphærium fabale Prime, in nearly all of the smaller streams of northwest Louisiana, and is often found in the greatest abundance. It is the most common species of the genus in the section.

Sphærium transversum Say. Dorcheat Bayou and Lake Bisteneau.

There are, undoubtedly, many other species of the *Cyrenidae* in the section. We have collected immature examples of other species, but there is too much doubt attached to their identification to justify entering them on this list.

Cambridge, Mass., July 16, 1893.

TRENTON AND SOMME GRAVEL SPECIMENS COMPARED WITH ANCIENT QUARRY REFUSE IN AMERICA AND EUROPE.

BY H. C. MERCER.

The recent Trenton gravel discussion impresses upon us, two important points:

(a) The proved fact that in the fashioning of his larger stone blades, the modern North American Indian continually scattered his quarry sites, with forms like the Trenton forms.¹

(b) The assertion that the Trenton specimens (see collection at Peabody Museum, Cambridge, Mass., Figs. 4 and 5,) may not have been found in place, but in talus, or where they had "slipped down," and that if in place, they did not prove a paleolithic culture, since if, as is possible, they were "rejects or wasters" dropped at quickly abandoned "workshops" on the uninhabitable river shore, the camp-site of the man who made them, with his "finished implements" and culture-telling traces, would probably have existed elsewhere higher up the bank.

In the demand for renewal of evidence which has grown out of the argument, we not only ask whether the Trenton objects are really found in place, whether they are "finished implements," and whether the old river shores are analogous to modern quarries where the gravel man would leave no more definite trace of himself than a "waster;" but, turning to Europe, whence the discussion has drawn its first inspiration, we wonder what effect the study of American Indian

¹For a study of the "unfinished implements" made by modern Indians, at Flint Ridge, Licking Co., Ohio, see a paper by Gerard Fowke in the Smithsonian Report for 1884, and papers by W. H. Holmes upon the aboriginal quarries at Piney Branch, D. C.; and in Garland County, Arkansas, in *American Anthropologist* for Jan. 1890 and Oct. 1891. The Unpublished Report for 1892 of the Department of Archaeology of the University of Pennsylvania contains a discussion of similar facts discovered in the summers of 1891 and 1892 at Durham, Saucon Creek, Vera Cruz, and Macungie, in Eastern Pennsylvania.

quarries is to have upon the question there. We inquire not unnaturally—

Are the *European* objects really found in place?

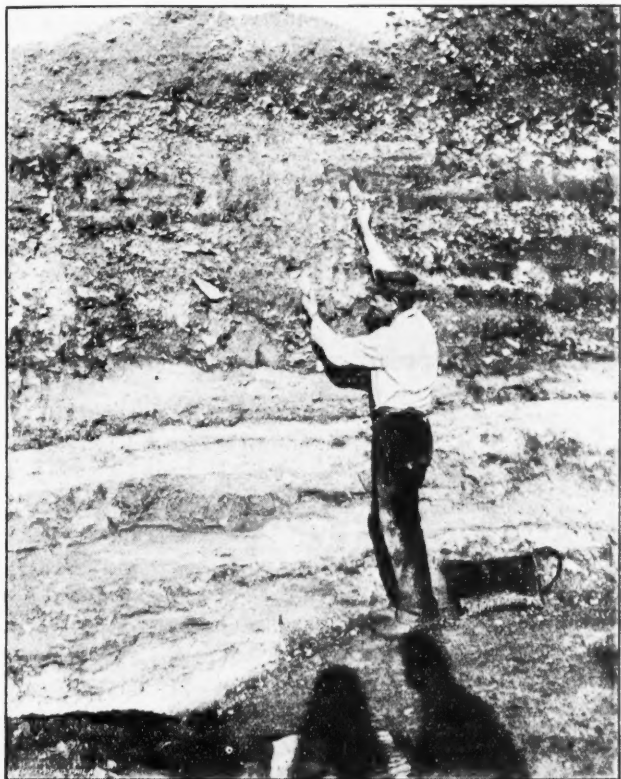


FIG. 1.

Chemin de Poste quarry, Abbeville (upper and oldest terrace), showing the unstratified "Limon rouge" resting upon stratified layers. Workman holds "axes" about where he says he found them in the "Limon rouge," December, 1892.

Do the Trenton specimens really resemble them?
Are the European specimens finished implements?

Have European archeologists overlooked the fact that there are later Stone Age quarries abroad, which, like the American sites, tell the story of blocked out "wasters" resembling gravel forms?

Postponing a few words of suggestion as to the first three questions, I venture here, on the strength of several recent visits to the Somme Valley, to discuss the last four, and first the question of

POSITION IN UNDISTURBED GRAVEL.

It is well-known that the Somme having cut its valley through the secondary chalk of northern France, had, in Quaternary times, washed up beds of gravel at bends, notably at Abbeville and Longpré, and at St. Acheul and Montieres (suburbs of Amiens). It was in these that Boucher de Perthes, after a long battle, was allowed, in 1859, to have really found his "haches" or "coups de poing" in place.

Visiting Abbeville in November last, and securing the kind assistance of M. G. d'Ault du Mesnil, a well-known geologist and paleontologist and member of the Ecole d'Anthropologie, who, as an inhabitant of Abbeville, had devoted much study to the gravels, I examined all the exposures near the town, then those of St. Acheul and Montieres, and finally the cuts at Chelles where the Marne has done the same work.

The sand and gravel pits (see Fig. 2, *infra*) A, Leon; B, Chemin de Poste; and on the open land, "Champ de Mars"

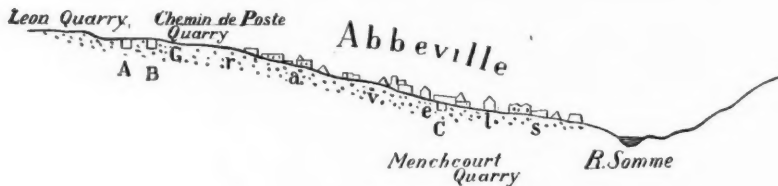


FIG. 2.

Diagram showing the general relative position of the Quaternary gravels to the River Somme at Abbeville (Dept. Somme) France, and A the Leon, B the Chemin de Poste, and C the Menchcourt sand and ballast quarries, from which chipped specimens and fossil bones have been obtained.

behind the town, are about a mile from the tide-less fresh-water Somme, and about 40 meters above it. They are holes dug in gardens and grass fields, on an exceedingly gentle slope, and their position avoids the difficulty of comparatively modern talus encountered at the celebrated Trenton bluff, just as a well or cellar dug in the middle of the latter city would.² C is the Menchecourt quarry near the river. A and B might stand as well for the St. Acheul pits if Abbeville were Amiens, when C would do for Montieres.

The gravel pits A and B, at Abbeville, will serve as types. The cuts, now about 10 to 18 feet deep, were, at places, clean and fresh, and showed veins of sand in white, yellow and red, and layers of large flint nodules, round by nature and packed in gravel, the whole overspread by the "Limon rouge," an unstratified layer 3 to 6 feet thick, of sand, gravel and weather-broken flint splinters.³ Classed as the last phenomenon of quaternary times, this "Limon rouge," tinted brownish red by atmospheric agencies, had, said geologists, rolled like a pudding over all the gravel area, from the uppermost or oldest terrace or bed, to the lowest or latest.

The difference between these exposures and those at Trenton was striking. There, where all stones were water-worn pebbles, and but few constituted blade-material for primitive man (argillite), here, scarcely any were water-worn, and nearly all were blade material (flint). In Trenton there was no fossil-preserving chalk; but here the presence and chemical effects of chalk were everywhere apparent.

² There is a "Puit" at the Leon Quarry, where a hole formed by decomposition in the underlying chalk, an area of about 75 feet square has settled down 4 or 5 feet. The stratification of the sunken area is somewhat jarred, but its line of faulting clearly marked against the clean cut layers to the right and left. The danger of replacement as well as those of changed water-courses anciently filled up, root holes, uprooted trees, confront the student here as everywhere. Well might he use caution, even were he in a hole 100 yards from the bluff's edge at Piney Branch, at the bottom of a trench 200 feet from the "quartz workshop talus" at Little Falls, or down in the Trenton sewer.

³ This phenomenon of weather splintering can easily be seen still at work. Many nodules yet unbroken, show on their surface discolored lines fringed with dendrites, marking planes of internal decay which have so weakened the mass that it falls at once into angular pieces on being struck a good blow.

My first object after observing my height above the river and the colored lines of stratification, with their inference of a valley-filling flood, was to note all evidence in proof of the quaternary age of the gravels, and of the occurrence in them of the chipped specimens and fossil bones that had made the spot famous.

I carefully examined every cut at the Leon, Chemin de Poste, and Menchecourt quarries, and afterward searched those at St. Acheul and Chelles, and the Archeological Museum of the University of Pennsylvania now contains three apparently artificial chips, which I then found in place; (1) Museum number 11456 with 3 facets on one side, showing the bulb of percussion, and well worn or worked on the edges, found and photographed in place $1\frac{1}{2}$ meters below the surface at the Chemin de Poste quarry; (2) Museum No. 11454 apparently artificial with 6 facets on one side, in place $2\frac{1}{2}$ meters below the surface at the Chemin de Poste quarry, and (3) Museum No. 11456, a thin flake showing the bulb and concentric circles of percussion, at the Leon quarry 2 meters below the surface. But the flint nodules of Abbeville flake very easily when struck against each other, and when we realize that the gravel deposits have been "ravined" by streams in past time, that cavities have been formed in the chalk, into which the flints have fallen with more or less suddenness and force, and that the original deposition of the strata must have been accompanied with some jostling of nodules, we need not attribute every flake showing the bulb of percussion, to the hand of man.

These specimens though far more artificial looking than many that have been proved artificial by surrounding circumstances must therefore be classed as doubtful, and we will not perplex ourselves with an analysis of their position in its exact relation to unstratified Limon Rouge and the stratified beds beneath.

Beyond these possible traces of human handiwork, I found nowhere a fossil or "coup de poing" in place.

However, at the Leon quarry, a workman showed M. du Mesnil myself 3 typical leaf-shaped specimens, recently found, he said,

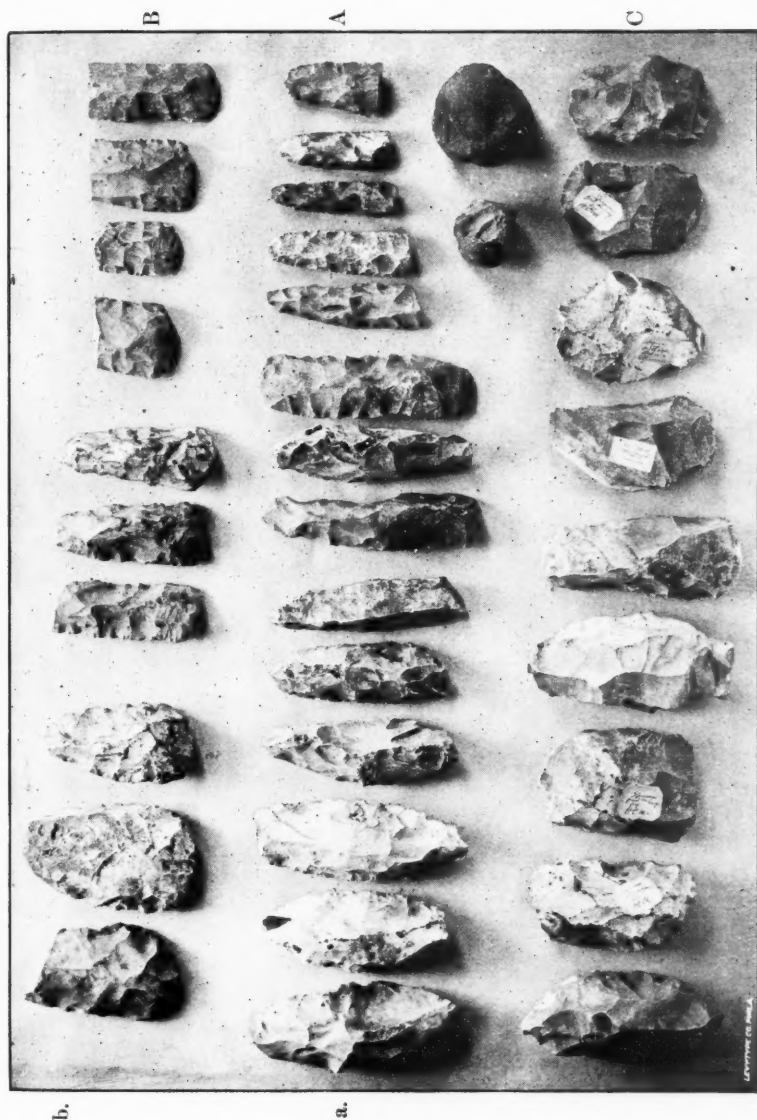


FIG. 6.

Series of specimens from the Neolithic quarry at Spiennes (near Mons, Belgium.)

A. Results. Long thin blades worked toward a point.

B. Results. Chipped Celts—Round cutting edge specialized.

a. Blocked out forms tending toward class A. b. Blocked out forms tending toward class B.

C. Hammerstones and inchoate masses, intent indeterminate, often resembling the rudier forms from Abbeville.

by him, one of which was covered with white patina, and three months later (on a second visit), sold me an elephant's tooth at the quarry (for 2 francs). Another laborer at the Chemin de Poste quarry sold me (for 4 francs) four chipped specimens (2 patinated), and again, three months later, 8 (for 5 francs) found by him, he said, in the "Limon rouge" at the spots indicated (see photograph, figure 1). At the Boulevard quarry at St. Acheul, I bought of a third workman, at least a dozen broken "axes" and chips, some of them well patinated, together with the bones of a *Bos primiginius* (for 5 francs).⁴ A fourth quarryman, at Chelles, where two tables in the foreman's shed were piled with "axes" and the teeth and bones of the *Rhinoceros tichorinus*, *Elephas primiginius*, *Equus caballus* and Reindeer recently found, it was said, and reserved as the property of the company; sold me at his house a number of patinated chips and "coups de poing," together with three teeth of the *Equus caballus* (for 5 francs).

Nothing so distinguishes the Delaware from the Somme Valleys; nothing so eliminates, from the study of the latter, the doubts as to readjustments and talus, the possibilities as to river levels and distant glaciers, which perplex the American investigator, as the presence of these fossils, thus luckily preserved by the chalk, and in sufficient numbers, it seems, to convince all men of science who have visited the spot. Though I found none with my own hands, it would have been hard to believe that those I saw at the quarries, in the Du Mesnil collection, at St. Germain, and in the Boucher de Perthes Museum, at Abbeville, had come from the surface or from anywhere else than the gravels themselves.⁵

⁴ One of the flint "axes" he laid aside, saying that it was an imitation.

⁵ Beyond these, thus labelling the beds in general as quaternary, the closer study of the bones had enabled paleontologists, I was told, to make out an evolution in the fauna of the valley, and distinguish three divisions or terraces—an upper, the oldest, marked by the prevalence of the *E. antiquus*, *Rhin. merckii*, and the advent of man; the middle marking the decadence and extinction of the *Elephas antiquus* and the *Rhin. merckii*, the prevalence of the *Rhin. tichorinus*, and the appearance and great increase of the Mammoth; and a lower, the latest, represented by the extinction of the Mammoth and the prevalence of the Reindeer.

The Carriere de Leon, Port St. Gilles, and Chemin de Poste quarries now represent the upper; the Balastiere du Chemin de Fer the middle, and the Menchecourt quarries the lower terraces.

The cut at Moulin Quignon and most of the exposures worked by Boucher de Perthes are at present covered.

As to the artificially chipped flints (see Fig. 3), twelve of those obtained by me were patinated with the brown, yellow, red and white patina that no art can adequately reproduce, for the forged patina is a crust, the real decomposition into the stone.⁶ To prove that they, like the fossils, came from the gravels, no evidence was wanting save that of a personal discovery.

COMPARISON WITH TRENTON SPECIMENS.

Did the Trenton forms resemble these French objects? was the next question. Figure 3 (omitting the so-called Mousterian flakes specialized on one side, and the thin, knife-like flakes and hammer stones from the upper beds) gives the three

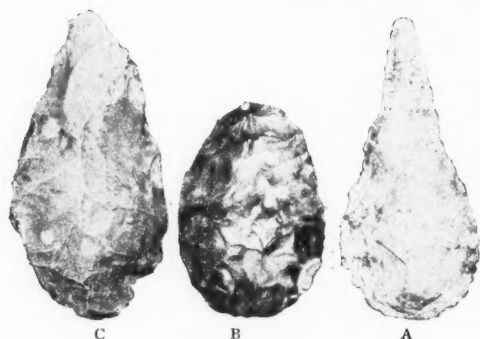


FIG. 3. 1

Typical specimens of flint from the Somme gravels at Abbeville. D'Ault du Mesnil collection. (Photographed by the kind permission of M. G. d'Ault du Mesnil.)

- A. Specialized only at the point. Rude at the base.
- B. Specialized all round. Leaf-shaped.
- C. Unspecialized. Resembling usual Trenton forms.

⁶ Some "forging" of specimens has been carried on in the Somme Valley, as the drawers full of imitations at St. Germain, and the specimens shown me in the Du Mesnil collection prove. M. du Mesnil has even detected skillful attempts at imitation of white patina at Amiens. He informed me that my unpatinated specimens were genuine. But they can be eliminated from the evidence without depriving it of much force.

important shapes found in the Abbeville pits. Figs. 4 and 5 present fifteen representative specimens from Trenton, in the Abbott collection at the Peabody Museum, Cambridge, Mass.

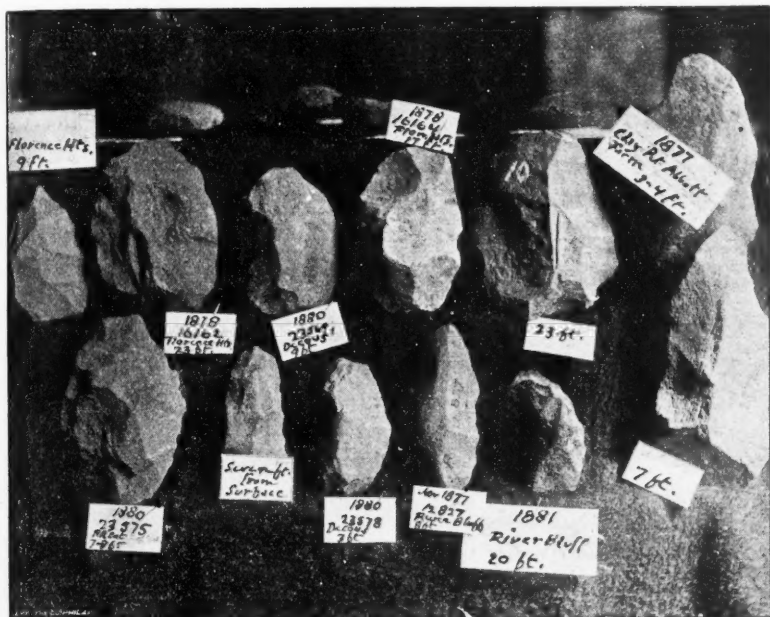


FIG. 4. 2

Trenton specimens of argillite from the Abbott collection, Peabody Museum, Cambridge, Massachusetts (photographed by kind permission of Professor Putnam, and Dr. C. C. Abbott, in September, 1893). Tickets show catalogued number of specimens, date of discovery, site, depth in Trenton gravels, etc., as stated in the Museum records.

The Trenton forms generally resemble C, Fig. 3. None are so finely worked as B (the duplicate of our heavier cache specimens⁷), while A, the most striking of all the "coups de poing,"

⁷ As, for instance, the 8185 flint blades arranged in sets of about 15, in mound 5 of the Hopewell group on the north Fork of Paint Creek, Ross Co., Ohio, discovered in 1847 by Squier and Davis and fully exhumed in 1891 by Mr. W. K. Moorehead (*Primitive Man in Ohio*, p. 189) or the 6107 similar blades, similarly placed, found by Dr. J. F. Snyder in 1890 in a mound on the right (Illinois) river bank near Beardstown, Brown County, Illinois. (See *The Archeologist* for Oct., 1893.)

scarcely worked at the large end where the nodule surface often remains, and finely specialized into a narrow point at the other, is, with the exception of the three specimens in Fig. 5, (the only ones of the kind from Trenton with a record as to depth and position), unlike anything in the described Trenton series, nor is it fairly duplicated by any of the American quarry or workshop discoveries that I have seen.

In the Boucher de Perthes Museum there are (down stairs) 48 specimens of A, (Fig. 3) and 47 of B. In the British Museum, 192 British specimens of A (Fig. 3) and 30 of B. Of C there are 32 in the Boucher de Perthes, and 97 (from Britain) in the British Museum, and the fact that these latter, save in material, are exactly resembled by the Trenton forms and American quarry specimens, brings us to the next question.

IMPLEMENTS FINISHED AND UNFINISHED.

Are the European specimens finished implements? In attempting to answer which the following facts offer some suggestion.

Of the 48 French (Boucher de Perthes, Abbeville) examples of A (Fig. 3), all very rude and unworked at base, where 28 retain the pebble surface, 29 are quite unmistakably specialized at the point; and of these 29, 10 look fresh and unused, while 19 seem to show signs of use or water wear. Of the 152 British (Museum) A's, 96 are unmistakably specialized at the point, while very rude, and generally showing nodule surface at the base.

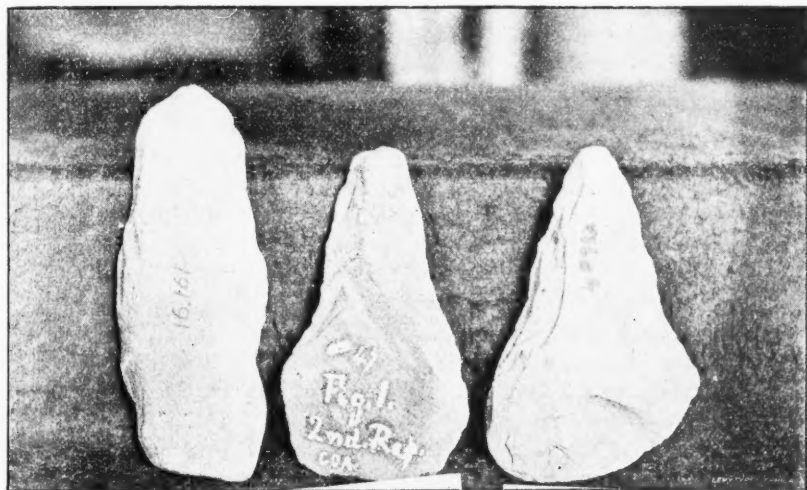
Eleven of the 47 French B's (well-specialized all around, 3 to 5 inches long), show signs of use or rolling.

Of the 32 French C's about 14 look rolled or used, and of the 97 British C's (of which W. G. Smith's unused-looking specimen resting on the elephant bone, in the "Paleolithic floor" case, is one), about 20 are made, not of flint, but of red quartzite.

Water, rather than use, may have rolled and nicked the edges of any of these flints (except, perhaps, W. G. Smith's) since they were made, and if we must eliminate these battered cutting edges (which I did not look for in the British cases) from the

pros and cons of a gravel specimen, whether in Europe or America, nothing remains for the student but analogy with stone implements from other regions.

Judged by this, the 77 French and British B's might have to be left out, because they resembled American cache forms. But the 19 French and the 152 British A's, rude masses tapering to fine points, could not, until some ground of doubt is suggested, escape the category of finished implements.



No. 16161.
4 feet from surface,
R. R. cut, 1878.

No. 11752.
Gravel of Trenton
bluff, 7 feet.

No. 45913.
R. R. cut, 7 feet.
May, 1888.

FIG. 5. $\frac{1}{2}$

Three Trenton specimens (Abbott collection, Peabody Museum, Cambridge, Mass.), rude at base and worked to points, resembling (though lacking the specialization of the latter) the rough based pointed forms from Europe (see Fig. 3, A). The labels on the margin give the Museum record.

As to the position of these forms in the Somme gravels, M. du Mesnil makes a statement which, though contradicted by

* Five of the 47 French are little ones, from $2\frac{1}{2}$ to 3 in. long, also well-specialized. The 30 British specimens of B are much ruder than the French. There are also 5 or 6 little French specimens, 2 to $2\frac{1}{2}$ in. long, of the rude pattern C. Eighteen French or 56 British look like blocked out or unfinished forms of A.

certain archeologists is of the greatest interest to the American student—that while A and C begin at the oldest layers and continue through the newest, B only begins in the middle stratum (with the Mammoth), to continue thenceforth with the others to the top.⁹

Granted the correctness of this observation, the student of American quarries would be tempted to call C, when lying as it does in the later beds, at or near the more perfect forms, a “waster or reject,” a preliminary step in their manufacture.

When found alone, however, in lower strata of the same gravel, he must fairly ask whether it does not represent an earlier stage in the process of stone chipping, when the savage, unskilled to proceed farther in the then experimental art, would have halted and treated as a finished tool, the same form which later, where finer work was understood and required, he would have cast aside as a “reject.”

This brings us to the last question :

THE “WASTER” OF THE EUROPEAN (“NEOLITHIC”) QUARRY.

Are there late Stone Age quarries abroad, which, like the American sites, tell a story of bocked out “wasters” resembling gravel forms?

At Grimes Graves (near Brandon, Suffolk, England) Canon Greenwell found, in 1880, surface conditions resembling those at Macungie, Lehigh Co., Pennsylvania).¹⁰ After digging 40 feet down into an ancient pit, he discovered horizontal galleries, and in them several chalk cups, a phallic figure cut in chalk, and pick-axes made of stag antlers, on one of which was the

⁹The opponents of this statement say that B has been found in the oldest layer. Its advocates, that when such has seemed the case, the specimens tumbled down through the ravining of streams. Unfortunately, it appears that in the demonstration of these points, few exact records have been kept of the stratigraphic position of specimens discovered. None, as far as I could learn, had been photographed in place, and probably not one in fifty was found by a scientific observer with his own hands. “We need,” said M. Reinach, in the St. Germain Museum, “a kind of hermit to live in the quarries, and pounce upon specimens as workmen find them.”

¹⁰See Notes on Exploration of Aboriginal Jasper quarries in the Lehigh Hills in 1891–92 (Popular Science Monthly, September, 1893.)

muddy imprint of a human hand. Cissbury (near Worthing, Sussex, England) explored by Col. A. Lane Fox, in 1867-75, repeated in general these discoveries.

At Grand Pressigny (near Tours, France), the fields are scattered with nuclei and thin flakes of flint worked from neighboring rock in situ, and no doubt there are hundreds of other European quarries yet unexplored, illustrating the handicraft of peoples living in times geologically more recent than the drift.¹¹

But Spiennes (near Mons in Belgium) will suit our purpose. Here M. M. Cornet and Briart saw, in 1868, a railway cut expose pits and horizontal burrows as at Grimes Graves and Cissbury, in one of which, at a depth of 8 or 10 feet, a fire-site and potsherds were found. The surface and slope of the chalk hill along the little valley of the Trouille, though talus hides the pit profiles, and the surface depressions are level, is still littered thick with refuse, which is, if we may believe European archeology, the work of a man who could make pottery and polish stone tools, and who, as compared with the Drift savage of the Somme is, geologically speaking, a modern individual.

I visited Spiennes in March, 1893, and, after seeing a neighboring collection, and carefully examining the refuse-covered area and several piles of "pierres taillées" in adjoining gardens, gathered with my own hands and obtained from peasants on the spot, a fairly illustrative series of the chipped forms of the quarry.

Figure 6, omitting nuclei and unworked chips, represents the types of the collection (142 specimens in all, including 4 hammer-stones).

Again, as in the American quarries, the story of partly finished implements preceded by "wasters" and inchoate forms,

¹¹ I. e., according to the European classification, the men of (a) the cave period, (b) the neolithic period, (c) the bronze period.

The paleolithic cave men, who, as we are told, never polished stone, polished bone, and scratched outlines of animals on bone, superior in realistic skill to anything done in the Bronze and Neolithic Ages. At Solutre, they chipped long, thin blades, equal to fine Mexican and Californian specimens, and at the quarries and workshops where these were fashioned, the American student might expect to find a set of "wasters" very familiar in appearance, yet certainly "paleolithic."

is plainly told. The considerably specialized results of the stone chipper's work at Spiennes, are shown in the two groups, A and B.

Of A—a long, narrow blade, worked to a point—I have 7 broken examples, and of B—the chipped celt—worked to a round cutting edge, 8 specimens likewise broken. Both A and B are plainly ushered in by a series of rude, less-specialized shapes, group a (of which there are 36) tending toward A, and group b (of which I have 35) tending toward B.¹²

When we come to group C, representing a series of inchoate masses, 19 in number, too little worked to be classified with the rugged relatives of either A or B, we realize a self-evident fact often before forced upon our attention. Having descended too far in the scale of chipped forms, we have lost our bearings. Judgment by type is at an end. Inference is dangerous. We have reached the point where the fortunately-discovered hearth, the blackened potsherd, or half-eaten bone must help to tell the tale—the point where all stones flaked but of a few chips, like “all cats in the dark,” are alike.

And the fact that this group C, from Spiennes, certainly runs into and resembles the rude drift forms from the Somme (Fig. 3, C) the American quarry-refuse specimens above noted, and Trenton Specimens (Fig. 4) means but little, when we observe, as we must, that the most specialized forms from the Spiennes quarry (Fig. 6, A and B) and Drift (Fig. 3, A and B) are quite unlike. Here we infer, if we may infer anything from the shape of worked stones, that where the quarry man was aiming at a thin, elongated blade, or a celt with round cutting edge, the Drift Man was working out a broad, leaf-shaped form, or the unique massive ended “coup de poing.”

¹² Two broken, polished celts, (group B) were obtained by me from a peasant at Nouvelles, 1½ miles away. But a peasant at Spiennes spoke of finding polished celts near the pits. So does Canon Greenwell, quoting M. M. Cornet and Briart in *Journal of London Ethnological Society*, 1871, p. 433.

The above numbers are given as they, from my own observation, seem to show roughly the relative proportion among the refuse, between the more finished and rude forms.

SUMMARY.

To sum up the above conclusions. A visitor, though refusing to take anything on authority, could find no fair reason to doubt that the French implements are found in place in the Somme gravels associated with quaternary fossils, as asserted by European writers. The whole question is simplified by the frequency of bones.

The Trenton specimens, though resembling the ruder and less specialized French types, never duplicate the specialized forms. The shape alone of the remarkable "coup de poing"

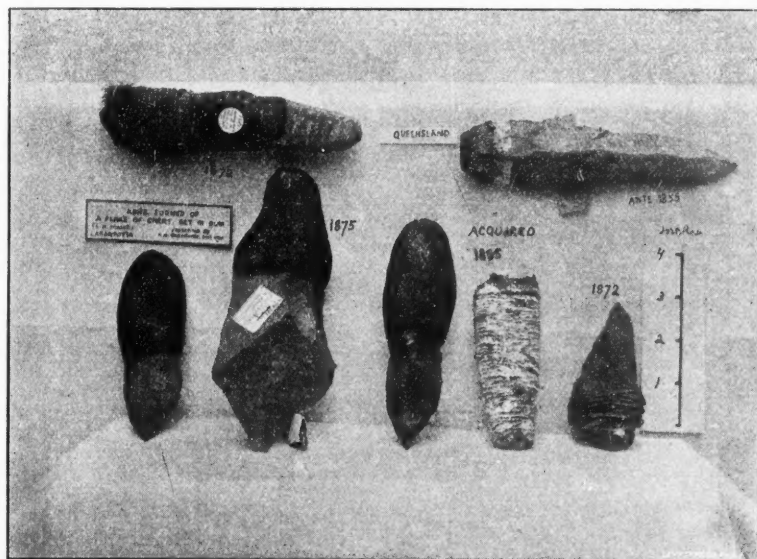


FIG. 7. 2

Australian stone flakes (un-specialized) set in gum handles and used as knives.
(Photographed by kind permission of Mr. C. H. Read, British Museum).

(Fig. 3, A) separates it from all Trenton specimens (except the three in Fig. 5). But its best examples are well-specialized, as is its more familiar leaf-shaped companion (Fig. 3, B), while none of the Trenton specimens are so.

Judged by the American quarry standard, certain of the above-mentioned ruder French forms (Fig. 3, C) might be classed as "rejects" thrown aside by the Drift Man in the fashioning of his finer blades (A and B).

The European neolithic quarry of Spiennes, like the American quarries, illustrates the production of "wasters" in the fashioning of large stone implements. But, in its more specialized results, the chipped celt and the long, narrow blade,

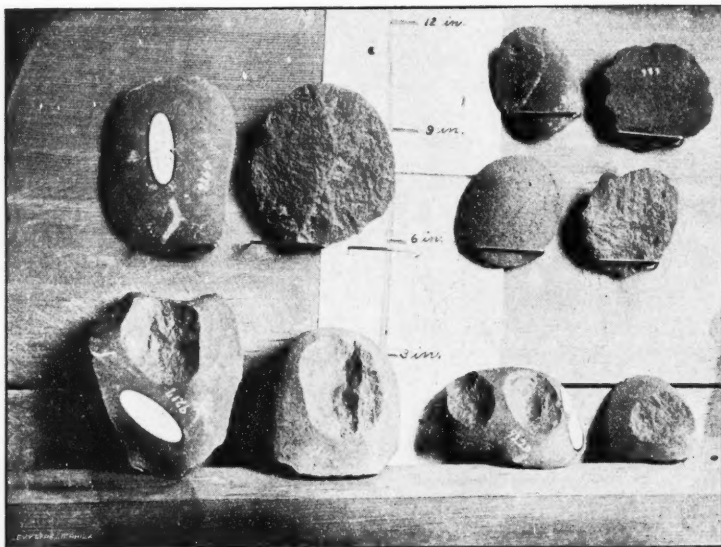


FIG. 8. $\frac{4}{13}$

Stone discs (resembling the "Teshoas" seen by Dr. Leidy in use among the Fort Bridger Shoshones as hide scrapers, in 1870) and river pebbles from which similar discs have been chipped. Found at Indian surface village sites in Delaware and Susquehanna Valleys in 1892.

it offers no resemblance to the leaf-shaped "hache" (Fig. 3, B) and the massive-ended "coup de poing" (Fig. 3, A) of the Somme drift.

While making these comparisons, we have realized that the light thrown upon the subject by the study of American quarries, important as it is, by no means settles the manner by

which all peoples in an age of stone made their blade-like implements, or gives us a universal clue to a "finished implement" wherever found.

We must bear in mind (1) that the Easter Island hafted obsidian splinters (Fig. 9) and the Australian unworked flakes (Fig. 7) set in masses of "black boy" gum, for use as knives, hammering tools or saws, prove that specialization is not a universal test of a finished implement. Though as "finished" as arrow-heads, who would call them so when the mounts had rotted? And who could distinguish the white flint flakes used recently by the Andamanese to shave their heads,¹³ or the Admiralty Island knife-chips of obsidian minus the gum, from "quarry refuse."

(2) That the "Teshoas" used as scrapers by the Shoshones (observed near Fort Bridger by Dr. Joseph Leidy in 1870),¹⁴ of which I have found duplicates in the Delaware and Susquehanna Valleys, together with the pebbles from which it appears that they have been knocked (see Fig. 8)¹⁵, are, though finished implements, not specialized, and illustrate a phase of pebble chipping not noted in the study of quarries.

(3) That the above-mentioned Easter Island hafted splinters, (See Fig. 9) though again finished implements, could not have been preceded by "turtlebacks" in their manufacture, and that the Jasper flake exhibited in the National Museum (see Ray Collection and Smithsonian Report, 1886, part 1, plate XX) as the starting point for arrow-head making among the north-west coast Indians, would probably not have looked like a "turtleback" or "quarry reject" if cast aside after partial working.

I found several little "turtlebacks" at the Jasper quarry at Macungie (about one inch in length), while the well-worked end of a small blade protruding from a shapeless mass at the Saucon Creek quarry, seemed to evidence a procedure not

¹³ See Observations by Col. A. Lane Fox, Journal of the Anthropological Inst. of Great Britain, etc., May, 1878, p. 446.

¹⁴ See Hayden's U. S. Geological Report for 1873.

¹⁵ See paper on "Pebbles Chipped by Modern Indians, as an Aid to the Study of the Trenton Gravel Implements," Proc. Am. Ass. for Adv. of Sci., Vol. XLI, 1892, p. 287.

involving the production of "quarry rejects" of leaf-shaped form. And it seems hard to escape the conclusion that if in some American cases the finished arrow-head or small blade is the fit survivor of a family of leaf-shaped "rejects;" in others (as certainly in the Mexican flake arrow, worked only on one side), it sprung from the nearest available chip, no more resembling the ovate quarry forms and Trenton specimens than would a bit of ill-worked bottle glass cast aside by California Indians.

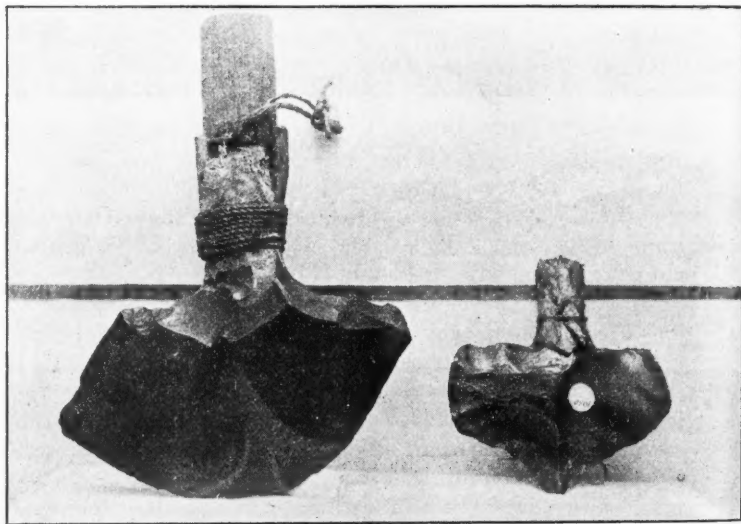


FIG. 9. $\frac{3}{4}$

Rude hafted flakes of obsidian from Easter Island.

(Photographed by the kind permission of Mr. Charles H. Read, British Museum).

EDITORIALS.

—It has always been recognized that scientific research is greatly furthered by the exchange of the various objects with which that research is concerned. For the transmission of objects of Natural History from one country to another, the mails have offered a cheap, speedy and reliable means. Heretofore, through the laxity with which the regulations on the subject have been enforced, it has been possible to enter such objects in the mails of the Universal Postal Union as samples of merchandise and under the rates of postage therefor. From official information lately received from the Post Office Department of the United States it appears that such a rating is entirely unauthorized by existing provisions, and that objects of Natural History may be mailed to countries of the Union only at the rates required for letters. The United States Post Office Department also states that it had recently submitted a proposition to the countries composing the Postal Union, to modify the regulations so that such specimens might be received into the mails at the same rates as samples of merchandise, but that a sufficient number of those countries had voted against the proposition to defeat it. The countries which voted negatively are Austria, Bolivia, British India, Canada, Germany, Great Britain, Guatemala, Hungary, Japan, Norway, Portugal, Russia, Spain, Sweden, Tunis, Uruguay, Venezuela.

The Academy of Natural Sciences of Philadelphia has therefore resolved to address the various scientific bodies, with which it is in communication, in those countries whose Governments have voted against the proposition, and to request those scientific bodies to memorialize their respective Governments in favor of the same. The following circular has been prepared.

The Government of _____ having voted in the negative, this Academy respectfully requests the favorable consideration of this question by your Society, and begs that it take such steps as it deems advisable to inform the Postal authorities of _____ of the manifest advantages to scientific research which would result from the adoption of the proposed modification, and to request those authorities to take such steps as may result in the adoption of the same. The letter rate for postage (Universal Postal Union) is ten times that required for samples of merchandise; such a rate for specimens of Natural History is virtually prohibitive. This Academy would respectfully urge upon your honorable Society prompt action on this matter if it meets with that approval which we so strongly desire.

President,

Recording Secretary.

As the above list of countries includes all the great powers of Europe excepting France and Italy, the necessity for the proposed action is evident.

—We have received the first number of a new geological periodical, "The Glacialist Magazine," published in London. The editorial corps includes the names of some well-known and able geologists, one of whom is an American. That this journal will be well edited we have no doubt, but we have some doubts of the propriety of adding another to the list of geological magazines now in existence. These number, in the United States alone, without counting more general scientific periodicals, five, the new one being the sixth which asks for a subscription. The probability obviously is, that unless they can be circulated gratuitously, new journals must fail of sufficient financial support. Such subscriptions as they receive are more or less likely to be withdrawn from existing journals, so that these may become impoverished. Geologists should rather concentrate than divide their publications.

—THE able geologist, Mr. W. T. McGee, has been appointed Director of the Bureau of Ethnology at Washington. Mr. McGee's important contributions to Geology are well-known, and we therefore fail to see the propriety of his transfer to another field where he has been until recently unknown. We say until recently, for he has become recently unfavorably known in Anthropology for an unparliamentary review of Professor G. F. Wright's book. This appointment was, of course, made by officials who were, we suppose, unacquainted with the facts in the case. We can only say that appearances would have been saved by a greater delay in the appointment; and anthropology would have been benefited by a longer apprenticeship on the part of Mr. McGee.

SOME TIME ago the Legislature of the State of Arkansas passed a resolution, which, declares that the pronunciation of the name of the state is *Arkansaw* and not *Arkansas*. Persons who are in a position to know, are aware that this resolution expresses the custom of the people of the State, and of the countries immediately adjoining, while in the east and elsewhere, the name is pronounced *Arkansas*, so as to agree with the pronunciation of the names of the States of Texas and Kansas. These customs have been fixed for a long time, for we find in Lewis and Clark's narration of their expedition, which was published in 1823,

the name spelled Arkansa. It is evident that this spelling according to the French pronunciation expresses that which long custom has made correct in English, and it therefore seems that it should be adopted in geographies and on maps, so that the confusion resulting from the pronunciation of the names Texas and Kansas may not be perpetuated. The case is quite different with regard to the native pronunciation of the name Missouri, which is Mizzoura. This is not supported by any linguistic reason, and is provincialism which time will probably abolish.

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WICKERSHAM, J.—Is it "Mt. Tacoma" or "Rainier?" Extr. Proceeds. Tacoma Acad. Sci., 1893. From the author.

RECENT LITERATURE.

Iowa Geological Survey.¹—The first annual report of the Iowa Geological Survey just issued is unusually attractive in appearance, and presents an interesting array of papers. That by Professor Calvin deals with some phases, of the, as yet, imperfectly known Cretaceous deposits occurring in Woodbury and Plymouth counties, and contributes important information concerning them. These deposits in the area studied consist of soft sandstone interstratified with bands of ferruginous nodules and variegated, often parti-colored, clays, overlaid by white, or yellowish chalk, in part indurated into beds of soft fissile limestone. White, in his report of 1870, termed this chalk the *Inoceramus* bed, from the great numbers of *Inoceramus problematicus* found in it, while the lower beds were called the Woodbury sandstone and shales. Professor Calvin, mainly on paleontological evidence, separates the latter into two divisions, the lower of which, chiefly sandstones containing impressions of leaves belonging to species of plants resembling our modern forest trees and with animal remains exceedingly scarce, he correlates with the Dakota group of Meek and Hayden. The second division, principally shales containing impressions of valves of marine molluscs associated with the vertebræ of bony fishes and the skeletons of marine saurians, is the Fort Benton group of the same authors, while the chalk represents their Niobrara group. The few molluscan remains found in the beds of the Dakota group are related to brackish water species and imply that the beds were laid down in an estuary, or at least in a region where the sea was shallow and large volumes of fresh water were poured into it.

The beds of the second division show a gradual change in the conditions of deposition owing to the deepening of the sea and the shifting of shore line farther east. True marine molluscs, and fishes and reptiles occupied the region, and left their skeletons to be buried in the finer mud that characterized the deposits then slowly accumulating in the open sea.

During the succeeding epoch where the chalk and shell-bearing limestones were forming, the water, by subsidence of the ocean bed, had become deeper, and the shore-line of the Cretaceous sea attained its farthest extension eastward probably reaching as far as the Mississippi

¹First Annual Report for 1892, with Accompanying Papers. Svo. 472 pp. with ten plates and twenty-six figures. Samuel Calvin, State Geologist, Des Moines, 1893.

in northwestern Iowa. *Inoceramus* multiplied over the sea bottom as oysters, if undisturbed, would crowd a modern oyster bed. Sharks disputed possession with the bony fishes and marine saurians. Everything betokens a deep, clear, open sea that spread away from the shore line in Iowa, over all the intervening plain, to the present site of the Rocky Mountains. Recent excavations and cuttings have shed much light on the Iowa Cretaceous and the present survey which will doubtless add much to our knowledge of this important group of rocks. There are two formations in Iowa, probably belonging to the Cretaceous, whose exact stratigraphical relations are at present doubtful, viz.; the Fort Dodge gypsum deposits and the Nishuabrtua sandstone.

The assistant state geologist, C. R. Keyes, contributes several papers the most important of which is on the classification of the Iowa formations. While in large part merely a summary of the work done upon these rocks in recent years by various workers, it also presents some important considerations derived from the author's personal investigations. In the revision of the classification, some needed changes in nomenclature appear, as St. Croix for Potsdam, Oneota for Lower Magnesian, etc. The attempt to correlate the Iowa rocks with the New York section is wisely abandoned. In the classification of the Lower Carboniferous, the formations included between the Kinderhook below and the St. Louis beds above are grouped together under the term Augusta. These beds comprise what Williams² called the Osage group, a name here shown to be inapplicable.

It is in his discussion of the Coal Measures, however, that the author departs most widely from the generally accepted views of Iowa geology. After some general considerations of the Coal Measure deposits, he calls attention to the two classes of sediments generally recognized, viz.; marginal or shore deposits, and those laid down in the open sea. In the Coal measures, as elsewhere, the first of these is characterized by rocks predominantly clay, shales and sandstones with practically no limestones. The sandstones often form great lenticular masses, sometimes deeply channelled on the upper surface, the excavations being filled with Coal Measure clays. These and many other phenomena attest a constantly shifting shore line and the shallow waters. The fossils are nearly all brackish water forms or shore species. On the other hand, the second class of deposits above mentioned is made up largely of calcareous shales with heavy beds of limestone. The former are chiefly composed of strictly open sea forms.

² H. S. Williams, *Bul. U. S. Geol. Surv.*, No. 80, p. 109.

As the conditions of deposition were evidently those of a slowly sinking sea shore, the marginal deposits or Lower Coal Measures practically underlie the open sea formations or the Upper Coal Measures. Hence in the use of the terms Lower and Upper, though allowable in a general way, it must be remembered that along any particular plane the two series of deposits are contemporaneous and their separation therefore would be represented by an oblique rather than a horizontal plane. Under this view the author proposes to divide the Coal Measures or Pennsylvanian series into (1) the Des Moines stage, representing the marginal deposits, thus including all the coal, and (2) the Missouri stage representing the marine deposits. These correspond essentially with the Lower and Upper Coal Measures as ordinarily given. The coal seams are shown to have but a limited extent generally, and to be nearly worthless for correlation purposes. The seams vary from a few inches to seven or eight, and even ten feet in thickness, the average of the seams now worked being between four and five feet. They are not disposed in continuous layers over the whole area as commonly supposed, but in numerous lenticular masses from a few yards to several miles in extent. Being confined to the marginal areas they are associated principally with the sediments characterizing that class of deposits, and have a slight seaward slope. They were laid down over an ancient eroded surface with hills and vales, ridges and gorges, and overlap Lower Carboniferous, Devonian, and even Silurian rocks. The paper is illustrated with numerous figures and diagrams showing graphically the structure of the Iowa coal field, and the essential differences between the views here advanced and those commonly held.

Other papers of value are presented by S. W. Beyer, H. F. Barie and G. L. Houser. That of Mr. Beyer treats of an interesting discovery of eruptive rock in a deep well at Hull, Iowa, at a depth of seven hundred and fifty-five feet, interstratified with beds of sandstone constituting what was considered to be Sioux Quartzite.

Additional facts bearing upon this occurrence of eruptive rocks in Iowa will be looked for with interest.

As a whole the report shows marked wideness of taste and care in its makeup, though the proof reader evidently mislaid his glasses at certain points, or was it the typo who failed to note the corrections?

C. H. G.

Correlation Papers—The Newark System.³—This essay, prepared by Mr. I. C. Russell as a bulletin, is the sixth of the series of

³ Bulletin of the United States Geological Survey, No. 85. Correlation Papers—The Newark System. By I. C. Russell, Washington, 1892.

Correlation Papers issued by the U. S. Geological Survey. Originally Mr. Russell intended to cover the entire Jura-Trias of North America, but circumstances compelled him to restrict his attention to those of the Atlantic border. This particular body of rocks the author calls the Newark System, a name proposed by W. C. Redfield in 1856, giving as a reason that it is the oldest specific title not implying opinion as to geologic age. These rocks extend from North Carolina to New Brunswick and Nova Scotia, but not to Prince Edward's Island, as has been asserted. They occur in narrow belts trending parallel to the application folds, covering an area of 10,000 square miles. It is Mr. J. Russell's opinion that the evidence now at hand bears out the theory that these detached areas are remnants of a once broad terrace which has been broken by orographic movements and greatly eroded.

The sedimentary rocks of the Newark System, consisting chiefly of sandstone and shale, were deposited in tide-swept estuaries, while the carbonaceous shales and coal seams originated in basins more shut off from the seas. The trap rocks are a part of the great system of dikes and sheets which intersect the surrounding crystalline and paleozoic rocks. The evidence of glacial action during the Newark period, Mr. Russell thinks is weak.

In discussing the relations of the Newark system to other terranes the author refers to the difficulty of correlating the rocks of America with those of other countries, and concludes that biological phenomena as a means of correlating, can be safely used only after the relative age of the strata has been determined from physical phenomena. Paleontologists of the Vertebrata will not concur in this view, for the vertebrate fossils indicate conclusively that the formation contains at least the representation of the upper member of the Trias or the Keuper. This was first definitely pointed out by E. D. Cope in 1866.⁴

The volume is accompanied by a very full bibliography, and is illustrated by many handsomely executed colored and uncolored plates. The colors of the geological maps are in general accordance with those in use by geologists.

Spalding's Guide to the Study of Common Plants.⁵—It is a pleasant thing to take up a new book and find our expectations not dis-

⁴ Proceedings of The Philadelphia Academy, pp. 249-50, 290. This reference is omitted by Mr. Russell from his table of determinations on p. 17, but is included in the Bibliography on p. 170.

⁵ An introduction to Botany. By Volney M. Spalding, Professor of Botany in the University of Michigan. Boston, U. S. A. D. C. Heath & Co., Publishers, 1893, pp. XIII 246.

appointed. The author of the little work before us has for many years been a successful teacher of Botany in one of our great State Universities, and has had not only the experience which his own teaching has brought him, but he has seen much of the results of botanical teaching in the high schools which annually send up their graduates to the University. The book is intended for use in such preparatory schools and was prepared in answer to frequent inquiries from high school teachers.

The leading thought in the book may be gathered from the following sentence in the chapter addressed to the teacher. "In order to use these exercises successfully it will be necessary to adopt the laboratory as distinguished from the text-book method of instruction."

Two short chapters are given to the discussion of the proper outfit for a botanical laboratory for high schools.

One of these includes lists of works of reference under several heads: "Laboratory Manuals," "Structural and Physiological," "Morphological and Systematic," "Floras," "Cryptogamic Botany," "General," and "Current Literature." The lists are well made and the author well says the books named "ought to have a place in any respectable school library."

The other chapter under this head gives good suggestions about the laboratory itself, the tables, microscope (small "Continental" stands recommended), glassware, regents, etc.

Then follow laboratory studies of seeds, growth of plants from the seed, root, leaf, flower and fruits. These serve to train the pupil to close observation. He then takes up the careful study of plants representing the natural groups of the vegetable kingdom. Thus the "Seaweeds and their Allies" are represented by pond scum (*Spirogyra*) and green felt (*Vaucheria*); mosses and liverworts are taken next, followed by ferns, horsetails, club-mosses, the pine family, the grass family, etc., though Monocotyledons and Dicotyledons, ending with the Compositæ. The treatment reminds one of that in Arthur, Barnes and Coulter's "Plant Dissection," of course much simplified.

The author has adopted a modification of Eichler's sequence of the families of the flowering plants. Very properly, too, he makes a distinction between "families" and "orders" (. 241).

The book will, if used by our high schools, do much to improve the quality of botanical teachings below the colleges and doubtless will stimulate some of our colleges also to better work than they have been doing.

CHARLES E. BESSEY.

Annual Report of the United States Geological Survey, 1889-90. Part I.⁶—This quarto volume of 757 pages constitutes a record of the geological work of the survey for the years 1889-90. It comprises the report of the Director, giving a general account of the progress of the work during those years, appended to which are the administrative reports of the chiefs of branches and divisions, and two scientific papers by members of the survey. Both of these papers, the first by Mr. W. J. McGee on the Geology of Northeastern Iowa, and the second by Mr. A. J. Phinney, on Natural Gas Districts in Indiana, are the result of observations extending through a number of years.

The illustrations are numerous and excellent.

The Report of the Death Valley Expedition.⁷—This report is No. 7, of the series "North American Fauna" published by the U. S. Agricultural Department. It embraces the following special reports. Birds by Dr. A. K. Fisher; Reptiles and Batrachians by Dr. Leonard Stejneger; Fishes by Dr. C. H. Gilbert; Insects by Dr. C. V. Riley assisted by Drs. S. W. Williston, P. R. Uhler and Lawrence Bruner; Molluscs by Dr. R. E. C. Stearns; Desert Trees and Shrubs by Dr. C. H. Merriam; Desert Cactuses and Yuccas by Dr. C. H. Merriam; and the Localities by T. S. Palmer.

The expedition was under the direction of Dr. C. H. Merriam, Director of the Department of Animal Industry, who deserves much credit for the inception and execution of the plan. As a report of a single exploration, it is second to none of those sent out at various times by the Government, if thoroughness of work and importance of results to geographic, climatic, and hypsometric distribution be considered. The report on Mammalia which is yet to be issued, will be by Dr. Merriam, and we may anticipate that much of interest will be brought to light by its author, who is here in his favorite field.

The geographic distribution of the numerous species met with, is stated in terms of the system already adopted by Dr. Merriam in his report on the distribution of life in Arizona.

In this system Dr. Merriam⁸ discards the usual divisions, which

⁶ Eleventh Annual Report of the United States Geological Survey to the Secretary of the Interior, 1889-90. By J. W. Powell, Director, Part I, Geology, Washington, 1891.

⁷The Death Valley Expedition: A Biological Survey of parts of California, Nevada, Arizona and Utah. Part II, North American Fauna, No. 7. Washington, 1893.

⁸The Geographic Distribution of Life in North America with special Reference to the Mammalia; Proc. Biol. Soc., Washington, VII, p. 11. April, 1892.

were first proposed by Baird, added to by Cope, and divided by Verrill and Allen, which correspond in great measure with the geological divisions of the continent, and which are in part divided by lines approximately meridional. He regards the primary faunal divisions as corresponding in great measure with parallels of latitude. Thus his Sonoran region includes the Sonoran and Austroriparian of Cope, which thus extends from the Pacific to the Atlantic Ocean. But he recognizes the two divisions as of distinct though subordinate value, calling them respectively, the arid and humid districts. He does not adopt the Pacific nor the central regions. Dr. Merriam admits that his system does not express the relations of the aquatic vertebrates. But a system which does not take these into account must be defective. Moreover it is not difficult to show that the Batrachia and Reptilia as well as the fishes sustain the system of Baird and Cope, and Dr. J. A. Allen has shown in a review of Dr. Merriam's paper (published in the Auk) that the birds do also. The geologic history of the continent has had everything to do with the origin of this distribution of life, so that the system which conforms to it is likely to be the correct one.

In regard to the birds observed during the Death Valley Expedition of 1891, Mr. A. K. Fisher writes as follows:

"Baird's woodpecker (*Dryobates scalaris bairdii*) was quite common among the tree yuccas on the Mohave Desert at Hesperia, and its range was extended northward to Vegas Valley, Nevada, and the valley of the Santa Clara, in southwestern Utah, by Dr. Merriam. The vermilion fly-catcher also was secured in the same valley, though previously unknown north of Fort Mohave, Arizona. The Texas nighthawk (*Chordeiles texensis*) was found to be a common summer resident in all the valleys east of the Sierra Nevada from Owens Valley, California, to St. George, Utah, where Dr. Merriam secured the eggs. It was taken also in the San Joaquin Valley, California, near Bakersfield. Scott's oriole (*Icterus parisorum*) is another species whose range was carried northward from a short distance above our southern border in California to about latitude 38°, where it was common in places among the tree yuccas, and also on the slopes of some of the desert ranges as high as the junipers and piñons. Costa's humming-bird (*Claytonia costae*) was very common wherever water occurred throughout the desert region, ranging northward nearly to latitude 38°, and eastward to the Beavercreek Mountains, Utah. Its nest was frequently found in the low bushes and cactuses on the hill sides near springs and streams.

"The discovery that the gray-crowned finch (*Leucosticte tephrocotis*) breeds in the southern Sierra and in the White Mountains is especially

interesting both because its breeding range was previously unknown, and because no species of the genus had been recorded from the Sierra Nevada south of about latitude 40°, while the present species was common nearly to the 36th parallel.

"Most satisfactory results were accomplished in working out the distribution of Thurber's junco (*Junco hyemalis thurberi*) a recently described race whose range was not definitely known. In the Sierra Nevada it was common from the Yosemite Valley, the most northern point visited by any member of the expedition, to the southern end of the range, and in the desert ranges eastward to the Grapevine and Charleston Mountains, where its place was occupied, in winter, at least, by its more eastern representative, Shufeldt's junco. The little black-chinned sparrow (*Spizella atrigularis*) was found to be not an uncommon summer resident on the slopes of several of the desert ranges and also on the east slope of the Sierra Nevada as far north as Independence Creek in Kearsarge Pass. This was a great surprise, as heretofore the species has been recorded within our limits only along the southern border, and its presence was not suspected, until a specimen was taken in the Panamint Mountains in April.

"Le Conte's thrasher (*Harporhynchus lecontei*) contrary to our expectations, was a common resident throughout the principal desert valleys from Owens Valley at the east foot of the Sierra Nevada across southern California and Nevada to southwestern Utah, where it was found nearly to the summit of the Beaverdam Mountains." Its range was found to correspond nearly with that of the curious bush *Larrea mexicana* in our limits.

An interesting result is the discovery that the California condor (*Cathartes californianus*) is not so rare nor so near to extinction as has been supposed. A considerable number of individuals were seen by members of the expedition, mostly on the eastern side of the southern Sierra Nevada. Now that bisulphide of carbon is taking the place of strychnia for the destruction of mammalian pests of agriculture, it is to be hoped that the slaughter of this magnificent bird will be stopped, and that it will continue to add dignity to the noble scenery in which it dwells, as long as the country itself continues.

The determinations and descriptions of the Reptilia and Batrachia of this report are the work of Dr. Stejneger of the U. S. National Museum, and they are accompanied by field notes by Dr. C. H. Merriam. In the work of Dr. Stejneger, we see the ornithologist in herpetology. The critical quality of the work both as to the structural characters, and the literature, is beyond all praise; but species splitting is carried

to a length hitherto unknown in the science, and the nomenclature is reduced to a system which takes in all names, provided they got printed, no matter how.

The identification of some of Baird and Girard's type specimens, and hence species, is a service for which herpetologists will be grateful, and Dr. Stejneger places in the hands of naturalists the means of determining their value. That they will often disagree with his conclusions as to species, is to be expected. Thus by his own showing *Sceloporus magister* is not a different species from *S. clarkii*, although he thinks it is; nor *Hypsiglena texana* Stejneger sp. nov. from *H. ochrorhynchus*; nor *Bufo halophilus* from *B. columbiensis*. I have examined the series of Crotophytes in the National Museum with the view of ascertaining the standing of the recently described *C. baileyi* Stejn. and *C. silus* Stejn., and I cannot see in them more than poorly defined local races of the *C. collaris* and *C. wislizenii* respectively. The same is true of *Callisaurus ventralis* Hallow., as compared with *C. draconoides*. In nomenclature, we have all the nomina nuda of Fitzinger revived, and all the unclassical spellings of original authors carefully preserved. Thus we find Pituophis for Pityophis, Bascanion for Bascanium, and bi-seriatus for biseriatus. Such acumen directed to the proper spelling of names would be a material gain to science in this country.

Forty-four species of Reptiles were procured by the expedition, and twelve species of Batrachia. None of them are regarded as new⁹ to science excepting a Rana, which is called *Rana fischerii*. This appears to be very close to the *R. onca*, with which it should be further compared. The notes on the habits of the species by Dr. Merriam are very interesting and add much to the value of the paper. Before passing to the fishes, I pause to correct a misapprehension into which Dr. Stejneger has fallen, and which involves the veracity of the writer of this review. In adopting the name *pipiens* for the *Rana virescens*, he remarks that Garman has shown that the former is the correct name, and that he is therefore not responsible "as one might be led to believe from Cope's treatment of the matter," for the use of the second name (*virescens*). The paragraphs in which the reasons for the employment of the name *virescens* are set forth in my Batrachia of North America, were copied directly from MS. furnished me by Mr. Garman. Mr. Garman changed his mind after the publication of my book.

The region explored is not rich in fishes, but a good many specimens and species were obtained. The most important result is the discovery

⁹The new species described in the report are from adjacent regions.

of a new species of Cyprinodontidae which is nearly related to the Oristias of the elevated Lake Titicaca of Peru, which is the type of a new genus called by Professor Gilbert, *Empetrichthys*. As in the Peruvian genus there are no ventral fins and no lateral line, and the very large pharyngeal bones are fused below. This fish inhabits the inhospitable waters of the Amargosa River, which, while not elevated like the Peruvian lake, flows through a region of similar geologic age. Another interesting discovery is that of the rare *Lepidomeda vittata* in a stream on the western side of the Colorado drainage in Nevada, far from the only locality previously known, which is the Colorado Chiquito of Arizona on the eastern drainage.

In an introduction to the report on insects, Mr. Riley makes the following remarks:

"Taking first the Coleoptera, which represent by far the larger part of the collectings, they have for the most part been carefully compared with the national collection, and I have had the assistance, in the verifications, of Mr. M. S. Linell and Mr. E. A. Schwartz, both well acquainted with our North American Coleoptera. As the chief localities from which the beetles were obtained do not exceed seven, the list has been arranged in tabular series to prevent repetition of localities. This arrangement at once shows that the collection comprises some 258 species, representing 170 genera in 39 families. Of the total number of species arranged according to localities, twenty-eight (a) are of general distribution in North America, i. e., they cross the whole continent, and among them are six cosmopolitan species, while only a single species *Bradycellus cognatus* found in the Argus Mountains, belongs to the circumpolar fauna. About fifty of the species are widely distributed throughout the more arid regions of the west, and about twenty species belong more properly to the fauna of maritime or upper California. The bulk of these species, as will be noted, were collected in San Bernardino County. Deducting the three sets of species and a few others, e. g., the genera *Homalota*, *Scopæus*, *Scymnus* and *Cryptophagus*, of the distribution of which very little can be definitely said, there remain about 140 species which are more or less characteristic of the Sonoran fauna. Some nineteen species are undoubtedly new.

"In the Heteroptera the list represents merely the species that were readily determinable, while the balance, including the more interesting forms, have been referred to Mr. P. R. Uhler, of Baltimore, Maryland, who has kindly reported on them, with definitions of the new genera and species.

"In the Homoptera, as will be noticed, there are some interesting new species, especially in the family Psyllidæ, but until they are carefully compared I do not feel justified in making any remarks upon them, nor have I time just now to characterize the undetermined forms which I prefer to do in connection with the very many new species in the National Collection to which I have already given much study."

Mr. S. W. Williston prefaces a report on the Diptera as follows:

"That the larger part of the collection of Diptera from Death Valley and the adjoining regions sent me for determination by Professor Riley should be new to science is not strange, inasmuch as they are, for the greater part, members of families which have been but little studied in America. The collection is of considerable interest as adding three European or African genera hitherto unrecorded from America, among which the wingless Apterina is the most remarkable. After a careful search I have found it necessary to describe two new genera—one among the Dexiidae, the other an Ephydrinid."

The Land and Fresh Water Shells were examined and reported on by Mr. Robert E. C. Stearns, who refers to the more important ones in the following language.

"The more interesting forms obtained were the two species heretofore referred to Tryonia, until recently regarded as obsolescent or absolutely extinct, but which were found to be living, as elsewhere remarked. *Helix magdalenensis*, another interesting species described from examples collected in the Mexican State of Sonora in 1889-90 by Mr. Bailey, of Dr. Merriam's Division of Biological Exploration, was detected by Fisher and Nelson several degrees of latitude farther to the north than the habitat of Bailey's original examples and at a very much higher altitude. This latter, by its presence at this northerly station, contributes to our previous knowledge and data bearing upon the relations between the geographical distribution of species and environmental conditions or influences; and two fresh water forms, not before known, were added to the Molluscan fauna of the region traversed by the expedition."

This report is one of the valuable results of the establishment of the Division of Animal Industry of the Agricultural Department. We hope that the recent reductions in the force of the Department by the present Secretary has not affected the efficiency of the Division, as science in general and Agriculture in some of its aspects, would materially suffer.—E. D. COPE.

General Notes.

GEOLOGY AND PALEONTOLOGY.

The Laurentian of the Ottawa District.—In a paper recently published by Mr. R. W. Ells, the author shows that certain modifications of the arrangement of the Laurentian strata as laid down in the geological map of Canada, 1866, must be made. While it is as yet hardly possible to estimate correctly the thickness of the strata, there is no doubt that it has been overstated. The Anorthosite masses north of St. Jerome which had been placed in the upper Laurentian have been shown by Dr. F. D. Adams to be of intrusive origin. The limestones in both the Trembling Mountain section and the region between the Anorthosite area and Gatineau River in nearly every case occupy well defined synclinals.

The succession of strata in ascending order as revised by Mr. Ells is as follows:

1. Reddish-gray gneiss without distinct signs of bedding.
2. Reddish orthoclase gneiss showing a well stratified arrangement of beds.
3. Grayish and rusty gneiss passing into a regular crystalline limestone.
4. A series of schistose rocks, highly metamorphic, described in earlier reports as the Hastings series.

In conclusion the author calls attention to the fact that under the present arrangement of the Laurentian of Quebec the parallelism with the rocks of the system as displayed in southern New Brunswick is very close. (*Bull. Geol. Soc. Am.*, 1893.)

Relations of the Laurentian and Huronian Rocks North of Lake Huron.—This paper is an extension of one published by the author, Mr. A. E. Barlow, in 1890, and contains some further observations on the nature of the contact between the Huronian rocks of Lake Huron, described by Logan and Murray, and the Laurentian gneisses. As a result of his investigations, Mr. Barlow is convinced of the irruptive nature of this Laurentian gneiss and of its magmatic condition at a time subsequent to the petrification of the Huronian sediments. The following facts have led to this conclusion:— (1) The diverse strat-

igraphic relations of the two rocks along their line of junction. (2) The alteration of the sedimentary rocks along the line of junction. (3) The inclusion of angular fragments in the mass of the gneiss which are clearly referable to the adjacent sedimentary strata. (4) The occurrence of gneissic intrusions distinctly irruptive. (5) The absence of limestones, slates or quartzites, or any species of rocks indicative of ordinary sedimentation. (6) The general character of the rock itself. (Bull. Geol. Soc. Am., 1893.)

The Carboniferous Glaciers of Central France.—In a note on the geogeny and stratigraphy of the coal-measures of central France, M. A. Julien discusses the various problems to whose solution the key is given by the discovery of the glacial origin of the breccia in the coal-measures: (1) the cause of the glaciers of the coal-measures; (2) their centers of dispersions; (3) the direction of the glaciers for each basin; (4) the precise relative age of the breccia.

The cause of the glaciers is the elevation, at the beginning of the Upper Carboniferous period, of Alpine masses forming part of that chain which Mr. Marcel Bertrand designated, a few years since, the Hercynian chain. The formation of this chain caused the elevation of central and western Europe and displaced the carboniferous ocean as the Alpine chain, at the close of the Miocene epoch, expelled the Helvetian sea. In both cases these extensive orogenetic movements were accompanied by an enormous development of the internal activity of the globe resulting in the breaking out in Europe of that series of porphyritic volcanoes of the Permo-carboniferous epoch, and of trachytic and basaltic eruptions toward the close of the Tertiary. It is not, then, at all strange to find traces of Permian and Carboniferous glaciers since the conditions which produced the more recent glaciers were present also during those earlier periods.

With the aid of a careful lithological inventory of each basin, one can infer the height of the original mass, and the direction of the flow of the glaciers. For instance, those entering the basin of St. Etienne came from the north.

In regard to the relative age of the breccia, the author concludes that the Coal-measures of the basins of Epinac, Blauzy, Brassac, Langeac, Commentry, etc., are synchronous, that their formation has been simultaneous, and that they differ from each other only in having their upper beds more or less worn down by erosion.

M. Julien is thus led to synchronize, in spite of conflicting floral testimony stated by M. Grand'Eury, the beds of Rive-de Gier, Valfleury and Fouillouse, those of Epinac, Colombier, and Marais, at Commen-

try, of Combelle and of Chalède in the basins of Brassac and of Langeac all of which were in existence before the glacial formation in its maximum extension. For similar reasons, he synchronizes also the upper beds in the great sterile plain, such as those of St. Etienne, Grand-Moloy, and Sully, those of Blauzy, the upper bed of breccia of the Carboniferous terrain of Meaulne, and the beds of Brassac and of Marsange.

M. Julien also considers the extensive bed of Commentry parallel with the three divisions of St. Etienne (*Revue Scientifique*, Sept., 1893).

Quicksilver Ore Deposits.—An important paper by George F. Becker, intended for the use of mining engineers. The first section treats of data from observation, the second of theoretical inferences as to the transportation and precipitation of the ore and of the form of the deposits. In this connection the recent advances in the study of osmosis is pointed out. In closing, the author gives a brief résumé of recent developments in various parts of the world, in which he embodies the results of the investigations of Professor A. Schrauf on Idria and Mr. P. de Ferrari, on the mines of Monte Amiata.

Statistical tables accompany the paper compiled from Monograph XIII of the U. S. Geological Survey. (Extract from *Mineral Resources of the United States*, Calendar Year, 1892.)

The Discovery of Miocene Amphisbæniæns.—No fossil remains of Amphisbæniæns so far have been made known. Mr. J. B. Hatcher, so well known to paleontologists, had the good fortune this summer to procure two small Lacertilian skulls, in the White River Beds of South Dakota, which when shown to me, I at once recognized as belonging to the Amphisbæniæns. Professor W. B. Scott of Princeton College, for which Institution the collections were made by Mr. Hatcher, had the great kindness to allow me the publication of this very interesting find; and I give to-day a short description of the principal characters of the skulls, which will be followed soon by a full account with figures.

1. The larger skull, which measures 13 mm., from the middle portion of the condyle to the anterior end of the premaxillary, and $5\frac{1}{2}$ mm. at its transverse diameter between the posterior ends of the maxillaries is so close to *Rhineura* Cope, from Florida, that I am not able to place it with the present material in another genus.

The nostrils are inferior in position. The single premaxillary is widely separated from the frontals by the large nasals, which are distinct, and extend to the border of the muzzle, overroofing the nostrils. The

prefrontal is large, placed between parietal, frontal, and maxillary, forming the superior border of the orbit; the jugal is exceedingly rudimentary, only connected with the maxillary; there is in all living Amphisbæniens no postorbital arch. The squamosal is not free. One tooth on premaxillary, 6 pointed teeth on each maxillary. It is distinguished from the modern *Rhineura floridana* Baird, by the more slender form of the skull, and may be called *Rhineura hatcherii*.

2. The smaller skull measures only 10 by $5\frac{1}{2}$ mm. It is at once distinguished from all living Amphisbæniens by the presence of a post-orbital arch, and the very peculiar prefrontal.

The nostrils are inferior in position. The single premaxillary nearly touches the paired frontals behind. Premaxillary, nasals, frontals nearly meeting in one point. The nasals are distinct and extend to the border of the muzzle, over-roofing the nostrils. Prefrontal very small, placed between maxillary and frontal; separated from the orbit by a descending process of the frontal, which forms the anterior border of the orbit. Jugal complete forming a distinct postorbital bar; it is in connection with maxillary, frontal, and parietal. Squamosal well developed and free. One small tooth on premaxillary and 4 on each maxillary.

This form represents a new genus and a new family of the Amphisbæniens, which may be called HYPORHINA and HYPORHINIDÆ. The species may be named *Hyporhina antiqua*.—G. BAUR.

Walker Museum, The University of Chicago.

On Symmorium, and the Position of the Cladodont Sharks.—In a paper recently read before the Philadelphia Academy I have described a shark from the Coal measures of Illinois under the name of *Symmorium reniforme*. The genus *Symmorium* is a Cladodont which differs from *Cladodus* Agass. in having the axial elements of the pectoral fin fused with each other and with the proximal basilar elements, into a single piece.

The specimens on which this genus is founded throw much light on the structure of the Cladodont pectoral fin, and through it, on the question of the evolution of this organ among fishes. The fin basis described is mostly well preserved, and clear as to details of structure. It confirms the characters ascribed by Traquair to the pectoral fin of a *Cladodus* from the Lower Carboniferous of Scotland,¹ the only important difference being that in the latter the metapterygium is dis-

¹Geological Magazine, Feb. 1888, p. 82.

tinctly segmented, while in the *Symmorium* this element forms a single piece, except possibly at the extremity. According to Traquair there is an "oblong" proximal segment of the metapterygium "whose anterior portion seems to have absorbed the bases of one or two adjacent radials." In *Symmorium reniforme*, all the basals (radials of Traquair), are fused at their bases with the metapterygium. The basals are also more numerous than in Dr. Traquair's shark, for he says "some small radials are seen attached to the preaxial side of the first two segments—none on the others." My specimen agrees with Traquair's in the absence of basals (radials) from the post-axial side of the metapterygium, where indeed they are not to be looked for.

The structure of the paired fins here pointed out, sustains the views already announced by Dr. Bashford Dean² in a recent paper, and this author is to be congratulated that the view which he has put forth, is so fully sustained by the material in my possession. One hypothesis which he holds requires further confirmation; viz, that the metapterygium is formed by the fusion of the basal elements. The extensive fusion seen in the later genus *Symmorium* as compared with the earlier genus *Cladodus*, supports his position so far as it goes, but the origin of the primitive metapterygium is not thus explained.

My observations on *Symmorium*, together with those of Traquair, Jækel, and Dean, show that the median axis of the archipterygium is not propterygial or mesapterygial, but is metapterygial. This greatly simplifies the conception of the history of the Selachian fin, where the metapterygium supports the greater number of the other segments. It shows that the Ichthyotomi are not elements in the phylogeny of the sharks,³ but form a side branch. It is further to be observed that the essential distinction now discovered between the metapterygial and other elements of the paired fins, must be maintained in our future studies of them. A clear distinction between baseosts and axonosts in the paired fins has been hitherto wanting. For the present it may be convenient to regard the metapterygial elements as axonosts, and those which have originally been branches of that axis, as baseosts. The scapular base of the Selachian fin consists then of one axonost and two baseosts. The typical Actinopterygian fin will have as its scapular base, according to Gegenbaur's homologies, baseosts only, the metapterygial (axonost) elements having entirely disappeared.

It results from the preceding observations that the *Cladodontidae* must be removed from the Ichthyotomi where Dr. Woodward placed

²Transac. N. York Academy of Sciences, 1893, April, p. 124.

³See Proceeds. Am. Philos. Soc., 1892, p. 280.

them, and be relegated to his order of Acanthodii. The definitions of the three orders of Elasmobranchii derived from the fins, will then be as follows; those of the second and third being the same as given by me in the NATURALIST for 1889, (October, p. 854).

Paired fins ptychopterygial,

Acanthodii.

Paired fins archipterygial,

Ichthyotomi.

Paired fins basilo-metapterygial,

Selachii.

The term ptychopterygium is introduced to describe the paired fins of the Acanthodii, in which the basilar or radial elements spring directly from the body wall; the axial elements when present, being within the body wall. This structure is primitive, and sustains the view of Thacher, that the paired fins have originated from a lateral fold.—E. D. COPE.

Geological News.—Paleozoic.—During a recent geological exploration in the neighborhood of Mount Lambie in New South Wales, Messrs E. F. Pittman and T. W. E. David found several specimens of *Lepidodendron australe* in rocks of true Devonian age. This is an interesting discovery since, although surmised, it is a fact which has not hitherto been proved. (Proceeds. Linn. Soc., N. S. W., 1893.)

Among the important recent discoveries is that of fine larval trilobites in the Lower Helderberg formations south of Albany, New York. These specimens are referred by C. E. Beecher to the genera *Acidaspis* and *Phaëthonides*. They represent early stages of these genera when the animals had no thoracic segments, and when the separation between the cephalon and pygidium was not distinctly marked.

As a result of the study of these forms Mr. Beecher is confirmed in the idea suggested by Woodward and Edwards that the Trilobita may be considered as ancient or protoisopods. (Am. Journ. Sci., Aug., 1893.)

—According to Mr. C. S. Prosser the fossiliferous zone underlying the Oneonta sandstone in Chenango and Otsego Counties, New York, is not the top of the Hamilton but belongs in the Portage stage. The writer bases his opinion on faunal data. (Am. Journ. Sci., Sept., 1893.)

Mesozoic.—A femur found in 1838, at Slingaby, Yorkshire, has recently been identified by Dr. Seeley. He refers it to a small species of *Omosaurus* with the specific name *phillipsi*. This is the third species of this genus found in England. (Yorkshire Philosoph. Soc. Report, 1892.) Mr. R. T. Hill has published a list of the invertebrate fossils collected or obtained by him from the beds of the Trinity Division in Arkansas and Texas. Of the 34 Mollusca described, 12 represent new species. The families of Foraminifera, Echinodermata, Vermes, Mol-

luscoidea and Arthropoda have one species referred to each, of which the first only is known; the others are either indeterminate or new. (Proceeds. Biol. Soc. Wash., 1893.)

The jaw of a new carnivorous Dinosaur from the Oxford Clay of Peterborough, Eng., is figured and described by Dr. Lydekker in the Quart. Journ. Geol. Soc., Aug., 1893. It is of large size and solid structure, and appears to be nearly allied to the Thecodontosauridae. It differs from the described genera of that family by the marked deflection of the mandibular symphysis. Dr. Lydekker accordingly refers it to a new genus under the name *Sarcolestes leedsii*.

Professor T. R. Jones notes the discovery of 15 fossil Ostracoda, 13 of which are new, from the Upper Cretaceous series of Wyoming and Utah. Nearly all represent either fresh water or estuarine forms. Professor Jones has described and figured these interesting specimens in the Geol. Mag., Sept., 1893.—At a recent meeting of the London Geol. Soc., Mr. E. A. Walford described some forms of Bryozoa from the spinatus zone of the Middle Lias near Banbury, Eng. The new material shows the opercular aperture, and the opercula *in situ* with appendages and supraoral ovicells characteristic of the Cheilosionata. In addition he found giant cells (cistern cells) of form quite dissimilar from the ordinary zooecia and probably reproductive. The name Cisternophora is suggested for the genus of which several forms were described (Geol. Mag., Aug., 1893.)

Cenozoic.—Captain F. W. Hutton questions the propriety of the name, *Dinornis queenslandiae*, given by C. W. DeVis in 1884 to a struthious femur found at King's Creek, Darling Downs. Captain Hutton is inclined to refer the fossil in question to the Casuariidae since it possesses the posterior projection of the trochanterial surface, a character lacking in the Dinornithidae and Apterygidae, but present in the femora of both the Cassowary and the Emu. (Proceeds. Linn. Soc., N. S. W., 1893.)

The skull of a Lemuroid mammal found in the shell-marl in the south-west coast of Madagascar has been determined by Dr. Forsyth Major to be that of a gigantic Lemurid related to the extinct genus *Adapis* as well as to the existing Lemurids. The brain-case is small, the thickening of the bones of the skull is very remarkable. The tritubercular molars and premolars approach closely some Malagasy Lemurids. Dr. Major names this new form *Megaladapis madagascariensis*. (Proc. Roy. Soc., 1893.)

MINERALOGY AND PETROGRAPHY.¹

The Trachytes and Andesites of the Siebengebirge.—In the course of a discussion on the geological relations of the trachyte and andesite of the Siebengebirge, Grosser² describes the various occurrences of these rocks and gives an outline of their petrographical characteristics. The trachytes he separates into typical, andesitic and aegerine varieties, and the andesites into trachytic and basaltic kinds. In the typical trachytes hornblende phenocrysts are frequent, but crystals of this mineral in the groundmass are unknown. Among the andesites the trachytic variety is noted for the absence of dark components from the groundmass and their rarity among the rock's phenocrysts. The basaltic andesite is rich in iron minerals, both as phenocrysts and as constituents of the groundmass. The order of eruption was trachyte, andesite, basalt.

A Variolitic Dyke in Ireland.—A variolitic dyke from Annalong, County Down, Ireland, resembles in the hand-specimen the variolites from Mt. Genève. Cole³ mentions it as consisting of devitrified glass, often containing skeleton crystals of magnetite, augite and plagioclase, and enclosing spherulites that are much larger toward the center than at the edge of the dyke. Thin selvages, 1 cm. in thickness, with very small spherulites scattered through them, exist on the sides of the dyke. Beyond these there is an abrupt transition to material containing the large spherulites. The selvages evidently cooled and lined the walls of the crevice now occupied by the dyke, before the interior filling consolidated; for not only is the transition between the substances of the two portions sharp, but the spherulites of the interior mass have in some cases grown from the line separating the two portions.

The Chemical Nature of Eruptive Rocks.—Lang⁴ has returned to his study⁵ of the chemical nature of eruptives. After a critical examination of many fresh specimens, the author concludes that the mineralogical nature of igneous rocks cannot be determined from

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² *Min. u. Petrog.*, Mitth., xiii, p. 39.

³ *Sci. Proc. Roy. Dub. Soc.*, 1892, p. 511.

⁴ *Min. u. Petrog.*, Mitth., xiii, p. 115.

⁵ *CF. AMERICAN NATURALIST*, 1892, p. 334.

their chemical composition, but that types with the same general chemical relationships possess the same general mineralogical character. The author also gives his views on the relationships existing between the various rock types, as based on their calcium and alkali ratios, and, while not so stating it, he shows that the emanations from an eruptive center are consanguinous.

Norites in the Eastern United States.—Along a shear zone in the norite of Avalanche Lake in the Adirondacks, Kemp⁶ finds what he believes to be a schistose phase of the rock in which several new minerals have been developed. The massive norite consists chiefly of plagioclase, with a little hornblende, enstatite and magnetite. In the schistose rock, which is much more basic than the norite, are broken pieces of plagioclase, shreds of hypersthene, grains of green monoclinic pyroxene, pink garnet, greenish-brown hornblende, biotite and magnetite, of which both the monoclinic pyroxene and the garnet are supposed to have been produced from the hypersthene and the plagioclase of the original norite. The schist resembles an eclogite. The same writer⁷ records the discovery of a new occurrence of norite or of hypersthene gabbro at Artsdalen's quarry in Bucks County, Pa. It is associated with a limestone which is the matrix of a large number of metamorphic minerals. It is thought that this limestone may be a block brought from below by the eruptive. The region surrounding the quarry is underlain by pre-Cambrian rocks, but it is almost without exposures. The occurrence of norite here is interesting as affording a link connecting the otherwise separated Baltimore and Cortland areas of basic eruptives.

The Ottrelite Conglomerate of Vermont.—Reference has already been made in these notes to the discovery of an ottrelite conglomerate⁸ in the Green Mountains of Vermont. Whittle⁹ has now given us in more detail the description of its occurrence, and adds to this many items of interest concerning the dynamic schists associated with it. Among other things connected with the minerals of the conglomerate he mentions the secondary enlargement of clastic tourmaline grains and describes the alteration of microcline pebbles into quartz, sericite, biotite and albite. In one microcline there are many inclusions of limonite and rhombs of siderite. As the sericite grows it clears

⁶ Amer. Journ. Sci., Aug., 1892, p. 109.

⁷ Trans. N. Y. Acad. Sci., xii, p. 71.

⁸ AMERICAN NATURALIST, April, 1893, p. 382.

⁹ Bull. Geol. Soc. Amer., iv, p. 147.

the microcline of these, so that around each grain of the mica is a zone of pellucid feldspar, and on both sides of veins of the sericite are clear borders of microcline entirely free from inclusions of any kind.

Chalcedony and other Silicious Spherulites.—A well-illustrated article by Levy and Meunier-Chalmas¹⁰ treats of various forms assumed by the molecule Si O_2 in the production of spherulites. Chalcedony has heretofore been regarded as a mixture of quartz and opal. The present authors have had an opportunity to study some excellent specimens of silica spherulites and concretions from the gypsum beds in the Paris Basin. Chalcedony and two new forms of silica, called by the authors quartzine and lutcite, are the components of these concretions. All three of these substances are fibrous forms of the same mineral, which is positive and biaxial, with an optical angle varying between 20° – 35° . Thus they are different from quartz. The distinctions between the three varieties rest upon their habit. Chalcedony is elongated parallel to the base of the crystals, and quartzine parallel to the plane of their optical axis, while the lutcite fibers are elongated in a direction making an angle of 29° with the optical axial plane. The relation of the long axis of each variety to the optical constants of the mineral is carefully worked out, and the appearances of thin sections of their groupings are illustrated by eight beautifully executed photographs.

Petrographical News.—Andrea and Osann¹¹ ascribe the existence of a porphyry breccia at Dorsenheim near Heidelberg to the crushing of porphyry by faulting and the cementing together of the fragments thus made by siliceous material.

A series of high dipping crystalline schists near Salida, Col., is regarded by Cross¹² as having originated by the alteration of great flows of basic and acid lavas erupted in Algonkian time. Though the rocks are now hornblende and micaceous schists, some of them still present a few of the structural features of diabases and porphyries.

Danalite from Redruth, Cornwall.—Tetrahedra of danalite at Redruth, Cornwall, are associated with quartz and arsenopyrite. Miers¹³ mentions them as projecting from a layer of massive danalite with a thickness of from a quarter to half an inch. Some of the crys-

¹⁰ Bull. Soc. Franç. d. Min., xv, p. 159.

¹¹ Mitth. gross. Badisch. geol. Landesanst., ii, p. 365.

¹² Col. Sci. Soc., Jan. 2, 1893.

¹³ Miner. Magazine, x, p. 10.

tals measure 30–50 mms. across. They are almandine-red in color, are translucent, and have a light pink streak, a hardness of 5.5 and a density of 3.350. An analysis gave :

SiO ₂	FeO	MnO	ZnO	BeO	CaO	S	Total
29.48	37.53	11.23	4.87	14.17	tr	5.04	102.62

corresponding to R.S. 7RO. 3SiO₂.

Mirabilite Changed to Thenardite.—Two crystals of mirabilite implanted on a mass of rock-salt from Aussee, Salzkammergut, that has been in the possession of the University of Vienna six years, have, in this time, so changed that they now consist simply of a thin shell composed of a crystalline aggregate whose inner surface is completely drusy. Within this crust there is usually a hollow, but occasionally a part of the hollow may be filled by a group of crystals like those forming the shell. These crystals are determined by Pelikan¹⁴ to be *thenardites* of a short pyramidal habit, bounded by the planes P , $\frac{1}{2}P$, $P\infty$, $\frac{1}{2}P\frac{1}{2}$ and $\infty P\frac{1}{2}$, with an axial ratio of $a : b : c = .5970 : 1 : 1.2541$. The crystals had been kept during the six years in an air-tight enclosure at a nearly uniform temperature, so that the change from their original condition must have been due solely to the influence of the small amount of moisture within the enclosure.

Mineralogical News.—Crystals of the rare *uranatite* from Schneeberg, Saxony, and from the Joachimsthal, Bohemia, have been measured by Pjatnitzky,¹⁵ who concludes that they are triclinic and not orthorhombic as Zepharovich supposed. Their axial ratio $a : b : c = .6257 : 1 : .5943$. The mineral has a citron or sulphur-yellow color, with very weak dichroism. *Uranophane*, according to the author, should not yet be considered a species. Its chemical composition is the same as that of *uranatite*, but its crystallization has not yet been determined.

The rare plane $2O\infty$ has been detected by Pelikan¹⁶ on salt crystals from Stannia, Galicia. Upon examining sections of *halite* from this locality, the author discovered in them many inclusions of petroleum zonally arranged. The cavities in which the oil is contained are either pear-shaped or are negative crystals, entirely or only partially filled with the liquid, which must have been under greater pressure at the

¹⁴ Min. u. Petrog. Mitth., 1892, xii, p. 476.

¹⁵ Zeits. f. Kryst., xxi, 1892, p. 74.

¹⁶ Min. u. Petrog. Mitth., xii, p. 483.

time of its imprisonment. From the distribution of these inclusions the author concludes that the crystals were first cubes, then tetrahexahedra (20∞), and finally cubes, as at present.

Jannetaz¹⁷ has made an analysis of the black garnet *pyreneite*, now the subject of so much discussion¹⁸ in Europe, and has found it to consist of:

SiO ₂	Al ₂ O ₃	FeO	MgO	CaO	Total
39.4	10.0	18.6	1.0	31.21	= 100.21

It is thus neither melanite nor grossularite, but is intermediate in composition between the two. Its density is 3.7

Miers¹⁹ has succeeded in obtaining some excellent though tiny crystals of *orpiment* by dissolving in hydrochloric acid the marl in which nodules of this substance are found at Tajowa, Hungary. Under the microscope the little crystals appear with the orthorhombic symmetry. oP is the plane of their optical axes. Their axial angle for sodium light is $70^{\circ} 24'$ in air.

The same mineralogist²⁰ has repeated Gmelius' analysis of *helvite* from Schwarzenberg, and has obtained this result:

SiO ₂	FeO	MnO	BeO	Al ₂ O ₃	CoO	S	Total
31.85	4.26	42.47	14.25	.74	3.16	4.81	= 101.54

Dumortierite is recorded by Gonnard²¹ as occurring in the feldspar of a granite vein cutting the gneiss in a quarry at Ternières, Francheville, Dept. of the Rhone, France.

The same writer²² figures a few new types of *natrolite* crystals from the Puy-de-Dôm, and describes²³ the occurrence of crystals of *analcite* in the fissures of the porphyry at Agay, Canton Hyères, France.

Brazilite, analyzed by Blomstrand,²⁴ has the following composition:

ZrO ₂	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Alk	Loss	Total
96.52	.70	.43	.41	.55	.10	.42	.39	= 99.52

Experiments in Crystallization.—Hundt²⁵ has repeated Vogel-

¹⁷ Bull. d. l. Soc. Franc. d. Min., xv, p. 127.

¹⁸ AMERICAN NATURALIST, Oct., 1892, p. 849. Ib., Apr., 1893, p. 385.

¹⁹ Miner. Magazine, x, p. 24.

²⁰ Ib., x, p. 10.

²¹ Bull. Soc. Franc. d. Min., xv, p. 230.

²² Ib., p. 221.

²³ Ib., p. 231.

²⁴ Neues Jahrb. f. Min., etc., 1893, I, p. 89.

sang's experiments on the crystallization of sulphur from its solution in carbon bisulphide thickened with balsam, and has discovered thereby some new facts regarding the phenomena connected with the formation of crystals. He finds the globulites aggregating into *liquid* spherules of sulphur that may remain liquid for several days. Grains of sulphur that are melted on a glass plate may also remain in a liquid condition for a long time—in some instances, three months—before they solidify. Upon agitation with the point of a needle they immediately become solid. The author declares that there is no tendency among the globulites to arrange themselves into definite groups, as Vogelsang reported to be the case. In the largest drops, however, they may take definite positions, whereupon the entire drop may be made to crystallize by shaking or agitating with a needle point. The formation of crystallites is contemporaneous with that of the globulites, the latter giving rise to the large drops, which, upon solidifying, become spherulites, and the former growing into microlites by the accretion of *invisible* particles. The crystallites do not grow by the addition of globulites. These bodies add themselves to the large drops, and never to the small, solid embryo crystals.

Miscellaneous.—A couple of *slags* from the lead ovens of Raibl, Austria, have been examined chemically by Heberdey.²⁶ The composition of different portions of the various specimens were carefully worked out. In one specimen crystals of a lead-zinc *olivine* were found, the analysis of which yielded:

SiO ₂	PbO	ZnO	MgO	FeO	CaO	Total
16.62	61.50	18.16	1.99	1.69	tr =	99.96

Their density is 5.214 and axial ratio $a : b = .8592 : 1$. In an appendix to his main article the author gives the results of analyses of the limestone in which the galena smelted in the furnace occurs. One of these analysis yielded: $\text{CaCO}_3 = 53.50$; $\text{MgCO}_3 = 46.51$; Fe, Ti, Li = traces.

Dunnington and Whitlock²⁷ communicated the results of an analysis of a *black soil* from a point in the valley of the Red River of the North, about fifteen miles south of Winnipeg, Manitoba, and Corse and Baskerville²⁸ the results of analyses of *glauconite* sand from near Han-

²⁵ Mitth. d. miner. Inst. d. Univ. Kiel. B 1. H. 4., p. 310.

²⁶ Zeits. f. Kryst., xxi, 1892, p. 56.

²⁷ American Chem. Journal, 14, 1892, p. 621.

²⁸ Ib., p. 627.

over Court House, Virginia. Analyses follow (I, black soil; II, glauconite):

	Sand	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	SO ₃	CO ₂	P ₂ O ₅	K ₂ O	Org.	H ₂ O
I	59.82	5.45	.64	7.14	4.00	.61	.61	.03	.37	.13	1.91	12.49	6.86
	Quartz	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	K ₂ O	Na ₂ O	H ₂ O	Total		
II	2.76	47.45	7.33	12.03	9.43	.57	2.90	5.75	.42	9.85	=	98.49	
	8.22	43.34	6.62	15.16	8.33	.62	.95	4.15	1.84	10.32	=	99.55	

Schwartz has treated in a comprehensive essay²⁹ the history of the observations on *reciprocal changes* produced in polymorphous bodies under different conditions of temperature, and has, in addition, given the results of some independent observations of his own. The substances that have been experimented upon are: AgI, KNO₃, NH₄, NO₃, AgNO₃, Rb (NO₃), boracite, perchlorethane, tetrabrommethane, and copper, nickel, zinc and cobalt, sodium-uranyl acetates.

Ch. Friedell³⁰ has examined carefully a specimen of the meteoric iron from Cañon Diablo, Arizona, and, as a result of his study, has concluded that particles of black diamond (carbonado) are disseminated through its mass. A combustion of the residue obtained upon treatment of the iron by acids leaves no doubt but that the material consists principally of carbon.

²⁹ Gekronte Preisschr. Univ. Göttinger, 1892.

³⁰ Bull. Soc. Franc. d. Min., xv, p. 258.

BOTANY.

Kuntze's Revisio Generum Plantarum, Etc. III.—Professor MacMillan was perhaps right in saying that the present upheaval in botanical nomenclature was signalized rather than caused by the appearance of the first two parts of Dr. Kuntze's work in 1891. That is, it was the chaotic state of nomenclature which caused Dr. Kuntze to write his book, not Dr. Kuntze nor his book which caused the chaotic state of nomenclature. But while this is undoubtedly true, it cannot be denied that Dr. Kuntze's work has so thoroughly exposed the condition of things and thereby caused such extraordinary activity in nomenclature, that whatever good results from the present movement must be attributed almost wholly to the influence of his work. For, while the present upheaval, to use Professor MacMillan's apt term, was probably inevitable, and the state of nomenclature was such as to make it only a matter of time, yet Dr. Kuntze and the years of patient research culminating in his work must be recognized as the immediate cause.

But Dr. Kuntze has not been content to rest here with the movement fairly started. With admirable zeal he has followed up his first advantage, and in the third part of his work—or rather the first division of it—which appeared in August, he has shown that unlike most reformers, he can not only start a revolution but can guide it as well.

In the *Botanische Centralblatt* for June, 1893, appeared a preliminary sketch of what is set out more fully in the first sections of the third part of his work. He gave a list of all the reviews of the first two parts, and all the works dealing with nomenclature, and all propositions for reform from the appearance of his work to May 1893, together with brief criticisms of each. Now he brings together all the critiques of his book, quoting them in full, all the propositions for reform, and the material parts of all articles, etc., dealing with nomenclature, and appends a critical commentary. The critiques number about forty, and with the other articles, etc. commented upon make a list of fifty seven. It may be doubted if such a symposium has before been brought together on such a subject. Not only is it valuable of itself, but it must convince the most skeptical of the extent and significance of the movement Dr. Kuntze has set on foot.

In one respect Dr. Kuntze has a great advantage over his reviewers. He has devoted more time to the subject and knows more about it in

all its details than probably any man living. Consequently anyone attempting to criticize him does it at the peril of having a multitude of facts cited to him of which he had been but dimly conscious or of which he had never dreamed. Though one may not be able to agree with Dr. Kuntze as to many points, he must admit that a perusal of his commentary shows him fully able to cope with any of his adversaries and that he rarely comes out "second best." It should be added that this method of setting out the arguments of his opponents in full is in happy contrast with the far too common practice of criticizing single extracts without giving the context to show what they mean.

The Berlin propositions, particularly the notorious proposition 4, are well criticized in three languages, so that no one can mistake Dr. Kuntze's meaning. Dr. Kuntze in this and in the polyglot circulars sent to the members of the Madison Congress has shown that he is in earnest, and botanists owe him no little gratitude for the pains he is taking to secure a right termination to the movement.

In this connection his remarks on the Genoa Congress are noteworthy. He is perhaps a little too severe in his objections to the use of the Italian language by the Congress. It may be that to ask botanists to add Italian to the rather heavy list of languages they must know is too much. But the Italian botanists have certainly merited the recognition, and law or no law, if they keep on at their present gait, we shall be obliged to know something of their language. Besides we do not all have to wield foreign languages with the ease with which Dr. Kuntze handles them to be able to understand sufficiently the most of what a botanist has to say. But Dr. Kuntze's criticism on the international character of the Congress is well taken. It is folly for any Congress which is not international in composition to attempt international legislation. No laws will be observed till they are enacted by an assembly whose jurisdiction is beyond question and whose composition commands the respect of all countries.

The remaining sections discuss the orthographic license, supplementary resolutions to the Paris Code, "1753, *die Nomenclatur der Unbewussten*," and "1737, *die Neue Compromiss in spe*." These last two sections are devoted to the important question whether 1737 or 1753 shall be the starting point of nomenclature. 1735 which he first proposed, and which has a certain logical foundation in its favor, he now gives up for 1737 as a compromise. This is wise. The 1737 names where they differ from the names of 1735 are a great improvement on them. He gives a list of the changes necessitated in the names given in parts I and II by his new starting point. This list is a

considerable one, and as the 1737 names brought in are quite often those in common use lately, it gives new strength to his position by practically removing one of the commonest objections made to it. It has been noted by several that the changes demanded by the 1735 starting point were not so frightfully numerous as they have been represented. The changes in so-called current names (for in the last ten years at least we have had no really stable current names) required by the 1737 starting point are comparatively few, and in this his compromise has an advantage. American botanists have preferred 1753, and that date has served as the basis for the nomenclature of several American publications, and gained considerable foothold. I shall not at this time discuss the relative advantages of the two dates, but shall merely observe his arguments. To change from 1753 to 1737 would require no very great number of alterations, and one may well be satisfied with either date, provided absolute fixity is attained. Of the points he makes against the 1753 starting point the strongest one is this. He charges that in the *Species Plantarum* of 1753 there are a number of *genera vitiosa* which represent an undetermined number of modern genera, while the genera of 1737 to 1748 are mostly clear. There are even, he says, monotypic genera in 1753 which under one species comprehend several modern genera. This is a charge of considerable weight and he cites several examples in support of it. The other objection, that in starting with 1753 we become entangled in the question of determination of Linnæan species, is also not without weight. Our starting point ought to be free from any entanglements which will allow botanists in time to come to overhaul accepted names under the guise of enforcing the law and question their validity.

In calling the nomenclature of 1753 the nomenclature of the ill-informed, or as he translates it "badly instructed," botanists, he is perhaps right in the sense in which he means it. It was, he says, taken up by persons who were not fully acquainted with the circumstances. But few besides Dr. Kuntze were fully acquainted with the circumstances till the appearance of his book made it in some degree possible without years of special study.

The succeeding section is a discussion of signs for growth, etc. with a suggested international code. The most remarkable thing about this code is its elaborateness. It provides signs for nearly every conceivable form of growth, and, if it gets into use, it will necessitate constant reference to the key, as it would be no small task to memorize it. While such signs are very convenient, it may be doubted whether there is any advantage in so elaborate a system.

The remainder of the book is taken up with the "*Codex Nomenclaturæ Botanice Emendatus*," the Paris code amended and supplemented. This is given in German, English, and French in parallel columns. Most of Dr. Kuntze's amendments are already well known from the discussion in the introduction to parts I and II. This *Codex Emendatus*, whether adopted *in toto* or not, must serve as the basis for any future emendation of the Paris Code. The "leaks" have been pointed out by Dr. Kuntze, and must be stopped—whether in his way or in some other.

A few points in his discussion of orthography may be noticed. He proposes to translate the Greek *upsilon* always by *i* instead of *y* except in a few cases where *u* stands for it, as *Cupressus*. He also proposes to eliminate the *h* in Greek words except in the combinations *ch*, *ph*, and *th*. To these and a few other propositions of the sort, I think it may fairly be said that they rest almost wholly on "*Bequemlichkeitmotiven*." It will be hard for botanists with classical training to yield to them. The tendency to revolt from such rules, if they can be adopted, will always be strong. No rule founded on convenience or on anything but *right* can be sure of enduring observance. Dr. Kuntze has taught us this thoroughly already.

But aside from such details, Dr. Kuntze deserves only thanks for what he has done. Botanical nomenclature bids fair to have in him a second father.—ROSCOE POUND.

ZOOLOGY.

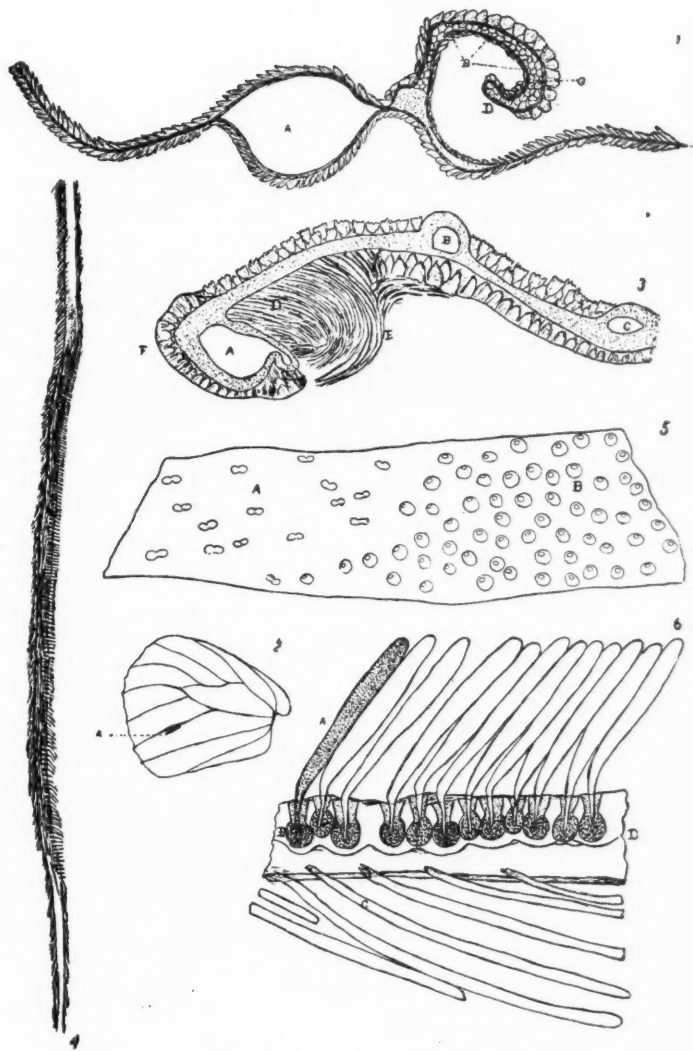
How Young Flickers are Fed.—An interesting account of a brood of young flickers is given by Mr. William Brewster in *The Auk*, July, 1893. During three days observation, Mr. Brewster saw only the male parent, which, however, was very attentive to his charge. Alighting on the trunk of the stump containing the nest, the flicker would utter a peculiar call, a low anxious *woi* or *wó-ä*, addressed, apparently to the young, to which they would reply with a burst of clamor, and almost immediately their wide opened mouths would appear at the top of the burrow. Standing on the edge of the hole, the parent selected one, and bending forward and down drove his bill to its base into the gaping mouth which insantly closed tightly round it, when the head and bill of the parent were worked up and down with great rapidity for from one to one and a half seconds, the young meanwhile never losing its grasp. These up and down motions were rapid, regular, and not unlike those of a wood-pecker engaged in drumming. They also suggested the strokes of a piston. If interrupted during the pumping process, the flicker would often feed the same young twice or even thrice in succession, but this never happened when the first period of contact was of normal length.

Four young were generally fed at each visit, with a brief interval of rest between the operations. During this interval the parent would open and shut his bill, run out his tongue, and work the upper portion of his throat as if tasting and swallowing something. The inference was that this was for the purpose of regaining the particles of food which had failed to lodge in the throat of the young.

The time spent at the nest rarely exceeded half a minute, while the foraging expeditions occupied from twenty minutes to an hour. The flicker's return was so stealthy that the writer, although on the watch, frequently did not see him until he appeared at the nest. His bill was always closed up to the moment of contact and there was no evidence that he carried food in his mouth. In fact, it was clear that he *swallowed* all the food obtained and afterward supplied it to the young by a process of *regurgitation*. Of what the food consisted, the writer was unable to discover without killing one of the young, to which mode of settling the point he was extremely averse.

Forsyth Major and Rose on the Theory of Dental Evolution.—In the *NATURALIST* for June, 1893, Professor H. F. Osborn

PLATE XXII.



Androchonia of Lepidoptera.

has stated the manner in which Kükenthal and Röse defend the theory that the complex dental crowns of the later Mammalia, are the result of the fusion of a number of primitive, distinct, simple reptilian teeth. Professor Osborn and myself have shown that the history of mammal dentition indicates the opposite process to have taken place; viz, the gradual accession of cusps to a simple primitive cusp, by a process of complication. The well known fact that the dental cusps become more numerous and display greater modifications with the passage of geological time, is opposed to the idea supported by the authors cited.

Dr. Röse has recently endeavored to explain¹ the origin of the dentition of the elephant. As is well known, the transverse crests are laminiiform, and reach the number of twenty-three in the *Elephas indicus*. It is also well known that as we pass backward in time we find in the earliest known proboscideans, posterior molar teeth with only four, and even two transverse crests. This fact is one of many which distinctly negatives the fusion theory. Dr. Röse's explanation is truly extraordinary. He declares the complexity of the molar of *Elephas* to be due to a reversionary inheritance of a reptilian dentition, and fusion of the dental elements of the same. Thus the farther removed from the ancestral Reptilia we get, in time and in character, the stronger becomes the hereditary tendency! This seems to be the *reductio ad absurdum* of the theory.

Dr. Forsyth Major makes an interesting contribution to the subject in a paper in the Proceedings of the London Zoological Society,² on the dentition of the Sciuridae. He announces his disbelief in the tritubercular origin of the placental mammalian dentition, and supports the view that all the forms, including the tritubercular, are the descendants of a multitubercular type, as now found in the Multituberculata. He believes that the superior molars of the squirrels support his contention, as he thinks that he can trace them better from a multitubercular than from a tritubercular origin.

I have stated as is my belief, as long ago as 1883,³ that the Glires were descended from the Tillodonts, and no reason has since appeared to invalidate this opinion. It was strikingly confirmed by the discovery that there were no Glires in the Puerco fauna, while Tillodonts are not rare. In the Tillodont dentition we have all the materials necessary for the evolution of the glirine dentition along the usual

¹Morphologischen Arbeiten von Schwalbe, Strassburg i. E., 1893, p. 173.

²Proceeds. Zool. Sci. London, 1893, p. 179.

³Extinct Rodentia of North America, AMERICAN NATURALIST, p. 380; Op. cit. 1885, p. 347 more definitely.

lines. Dr. Forsyth Major appears to have overlooked this aspect of the case, and it will be necessary to dispose of this theory before progress in any other direction can be made.—E. D. COPE.

Effects of Temperature on the Coloring of Lepidoptera.

—In *Insect Life*, Vol. III, p. 481, is given the following resumé of a series of temperature experiments conducted by Mr. Merrifield in pedigree moth-breeding, begun in previous years, on the pupa of *Selenia illustraria* and *Ennomos autumnaria*.

By careful and long continued experiments Mr. Merrifield has demonstrated the possibility of producing artificially from a single brood of a moth, subject to seasonal dimorphism, four distinct "temperature" varieties, viz.: summer markings with summer coloring, summer markings with an approach to spring coloring, spring markings with summer coloring, and spring markings with spring coloring. The conclusions reached as a result of this series of experiments are that the coloring and markings of the moth are affected by the temperature to which the pupa is exposed, the marking being chiefly produced by long continued exposure; that the coloring is affected chiefly during the stage before the coloring of the perfect insect begins to show; that a low temperature during this stage causes darkening, a high temperature producing the opposite effect, a difference between 80° and 57° being sufficient to produce the extreme variation in darkness caused by temperature; a further lowering of temperature having no further effect; that nearly the full effect in coloring may be produced by a range of temperature of from 76° or 80° to 65° in *autumnaria*, and from 73° to 60° in *illustraria*; that dryness or moisture during the entire pupal period has no appreciable effect on the coloring of the adult.

A general conclusion which the author ventures to suggest—provided we accept the theory of Professor Weismann, that existing forms of North American and European Lepidoptera have come down from a glacial period—is, that "icing" the pupa causes the insect to revert to its earlier form, and that experiments of the nature here recorded might be of material assistance in tracing the evolution of the markings on the wings of the most highly developed forms.

In a supplementary note Mr. Merrifield adds that it is possible to cause either the summer or winter form to take on the coloring of the other, and produce from moths from the summer pupa, specimens that resemble those from the winter pupa, but not *vice versa*.

The details of these experiments can be found in Part I, Trans. Ent. Soc., London, 1891, pp. 155–167.

Fish Acclimatization on the Pacific Coast.—The attention of fish culturists is called to the remarkable results of the experimental introduction of food fishes to the west coast of the United States. In 1871, the California Fish Commission deposited 12,000 young shad in the Sacramento River, and after that the United States Fish Commission carried on the work until 1886, during which time 609,000 young shad were placed in the Sacramento River, 600,000 in the Willamette, 300,000 in the Columbia, and 10,000 in the Snake River. Two or three years later a few mature examples were obtained in the Sacramento River, and, by degrees, marketable fish were obtained along the entire coast of the United States north of Monterey Bay. In 1887, they were abundant in some rivers, common in most of them, and occasional ones were found everywhere along this long coast line. In 1892, the catch was estimated at 660,000 pounds. A careful estimate places the total value of the shad catch on the Pacific coast to date at \$145,000, representing over 3,000,000 pounds, while the aggregate outlay for all purposes connected with the introduction of the fry was less than \$4,000.

The history of the striped bass, *Morone saxatilis*, is similar to that of the shad. In 1879, about 150 fish a few inches long were deposited at the mouth of the Sacramento River by an agent of the U. S. Fish Commission coöperating with the California Commission. In 1882, another plant of 300 fish was made in the same region. As a result of these two small plants, the species soon became distributed along the entire coast of California. The rapid growth of individuals, and the equally rapid distribution of the species indicate the special adaptability of the waters of the region to this fish.

In commercial importance the striped bass ranks high. Large quantities are taken for market in San Francisco Bay with seines and gill nets. The average weight is eight to ten pounds, but fish weighing forty pounds are not scarce. The aggregate yield to date is nearly 100,000 pounds with a value of \$18,000. The cost of introduction was not more than a few hundred dollars. In both of these cases cited the investment of the people's money has proved most satisfactory. (Science, Aug., 1893).

ENTOMOLOGY.¹

The Androchonia of Lepidoptera.—In general all the scales of Lepidoptera are modified hairs and originate as papillæ-like protuberances on the surface of the wing. In structure they are at first double walled closed sacs, but soon flatten out and striae appear; in greatest numbers on the outer surface. The arrangement on the wing may be regular or irregular. The coloring is a matter of some interest and may be due to the refraction of light on the finely ruled surface, or a pigment located between the two walls of the sac and away from direct contact with the air. But it is not the object of this paper to discuss the ordinary scales of Lepidoptera.

More than 50 years ago Bernan Deschamps observed other scales on the butterflies and from their shape called them plumules. The name was not a good one however, and has since fallen into disuse. The name androchonia was substituted and it is now the one by which the so-called scent-scales or hairs of the *male* Lepidoptera are known.

The androchonia are found in the same way as the ordinary scales, from papillæ which rise on the surface of the wing. As regards their occurrence they may be massed together in patches or scattered irregularly over the surface. If in groups they are always concealed by the large imbricated scales that seem to be congregated at that point to protect them. Often, however, they are protected by being located in a pocket or fold of some portion of the wing, as for example, in one tribe the Hesperidi, they are located underneath the reflexed margin of the fore-wings. This is their location in *Eudamus tityrus* where the marginal vein is folded back until it no longer forms the outermost edge of the wing.

In the common milk-weed butterfly (*Danaïs archippus*) they are located at the dark spot on the second pair of wings near the first venule of the median vein. In this case they are protected by a proliferation of the membrane of the wing which forms for them a pocket. On the second pair of wings in *Thecla calamus* they are simply collected in one region on the surface and protected by large scales which are very prominent at that point. When scattered irregularly over the wing they are always underneath the large scales and therefore well shielded.

The androchonia are very much smaller than the ordinary scales and can easily be identified. Some are black or brown but usually they are devoid of color. The color given to the patches where they occur

¹ Edited by Clarence M. Weed, Durham, N. H.

is usually due to the coloring of the large scales that are for their protection. The androchonia vary much in form, many of them being simply hair-like, others feather shaped or rod-like with a plumed tip. In structure they are much softer than the ordinary scales and consequently much more pliable, which later property serves a very efficient purpose in their concealment. There is often a canal extending from the base to the tip of the scale where it may find a direct outlet or disappear in the spongy mass found at the end of a large variety of these androchonia.

At the base of many are found the true ball and socket joints like that in the ordinary scales.

It has been shown by Weisman that the wings of the Lepidoptera do contain living tissue and this would allow the production of odors through local scent glands. This arrangement has often been conjectured but it seems that either no attempts have been made at a systematic study of the subject or the attempts have ended in failure. The trouble was no doubt due to a lack of care in the preparation of the material for study. It was found after repeated attempts that the best results were obtained by hardening the freshly removed wing in alcohol, infiltrating with collodion and preparing serial sections by the use of a microtome.

The results of careful study and repeated observations on many series of sections of various Lepidoptera has shown the androchonia to be the outlet of certain glands located in the tissue of the wing beneath the androchonia bearing surfaces. The glands in sections were very prominent and no doubt of their genuineness could be entertained. One especially prominent was found beneath the androchonia in the wing of *Danaïs archippus*. The character of the surface of the wing above the glands is often very interesting, it sometimes being covered with a great number of papillæ from the end of which the scent scales project; or it may be like the ordinary surface of the wing. In the former case the androchonia are quite small and but one to each papilla, at the base of which we find the gland. This gives the scent scale the appearance of a small rod placed in a flask. In the tissue of the wing we find numerous canals ramifying in various directions. The material elaborated by the local glands and distributed upon the surface of the wing by the androchonia is that which gives to many of the Lepidoptera their characteristic odor.

Müller has been able to recognize more than 30 distinct odors in different patches of these scent scales. The use of the odor is no doubt in many cases for protection, but it must also assist in sexual selection.

This study was undertaken at the suggestion of Professor J. H. Comstock, to whom I am indebted for the material examined.

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Wabash College.

Description of Plates.

Fig. 1.—Transsection of wing of *Danaïs archippus* showing the location and arrangement of the androchonia.

" 1a.—First venule of the median vein.

" 1b.—Androchonia bearing surface.

" 1c.—Glands below the surface and in the tissue of the wing.

" 1d.—The proliferation of the wing for protecting the surface.

Fig. 2.—Hind wing of male *Danaïs archippus*.

" 2a.—Location of androchonia (nat. size).

Fig. 3.—Transsection through the marginal vein of the fore-wing of *Eudamus tityrus* showing location of androchonia in the pocket formed by folding over the marginal vein.

" 3a.—Marginal vein.

" 3b and c.—Other veins.

" 3d.—Location of androchonia.

" 3e.—Large scales on the wing that protect the androchonia.

" 3f.—Edge of the wing.

Fig. 4.—Transsection of the hind wing of *Thecla calamus* at the place where the androchonia are congregated.

Fig. 5.—View of surface of the wing of *Thecla calamus* giving the arrangement and abundance of the scent scales as compared with the ordinary one. (6) Androchonia.

" 5a.—Ordinary scales.

Fig. 6.—Trans. of wing androchonia surface on the wing of *Thecla calamus*.

" 6a.—Androchonia.

" 6b.—Glands at the base.

" 6c.—Ordinary scales.

" 6d.—Wing in section.

Fig. 7.—Trans. of wing of *Thecla calamus*, showing the androchonia with large gland at base.

" 7a.—Androchonia.

" 7b.—Surface of wing.

" 7c.—Tissue of wing.

Fig. 8.—Gland.

Fig. 9.—Androchonia.

Figs. 10 and 11.—Androchonia in trans-and longisection.

Figs. 12-21.—Various kinds of androchonia and scales, showing relative sizes.

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Fleshy Cecidomyiid Twig Gall on *Atriplex canescens*.—

Numerous fleshy tumor-like twig gall, were found on *Atriplex canescens*, May 13, 1892, on mesa back of college grounds, near Las Cruces, New Mexico. One gall that was opened disclosed two cecidomyiid pupæ in separate cells within. This gall, with its occupants, was placed in alcohol. Other galls were pinned and allowed to dry. The latter, on being opened nearly a year later, disclosed a cecidomyiid larva, several cast pupal skins, and in one cell a transformed hymenopterous parasite. From the alcohol gall the following description is drawn.

Gall.—Length, 12 mm.; width, $4\frac{1}{2}$ to $6\frac{1}{2}$ mm. Rather oblong, more or less irregular in shape, fleshy when green, tumor-like, formed on one side of twig, which is itself involved in the gall. Pale greenish in color, sometimes more or less reddish as noticed in the dried galls. Outer skin of gall smooth. Two cavities inside, each about 2 by 3 mm. in diameter.

One specimen. This cecid may be called *Cecidomyia atriplicis*.

The dried galls show the twig plainly, not involved in the gall. They are red to greenish in color, surface naturally wrinkled and somewhat roughened, with sections of the thin bark of the twig showing upon the surface, but I am inclined to consider them the same as the above. This opinion is induced by the similar character of the occupants. The cells also are similar in size and shape, several in each gall according to size of latter. Some of the smaller dried galls are more rounded in shape.—C. H. TYLER TOWNSEND.

Trichodactylus xylocopæ in California.—Some little time ago I received from Mr. D. W. Coquillett, Los Angeles, California, an inter-

esting parasite of *Xylocopa*, and which proved on examination to be *Trichodactylus xylocopæ*.

As I know of no previous record of this Acarid, or any in this genus, being recognized in America, it seems worth while to mention it in the *Naturalist*. The specimens were taken from a Carpenter Bee and mounted in balsam by Mr. B. W. Griffith. The bee Mr. Coquillett says agrees with specimens named for him by Prof. Riley as *Hylocopa æneipennis*.

Doubtless this parasite could be found on *Xylocopa* in other localities and related species on *Osmia* and other related bees.

HERBERT OSBORN.

ARCHEOLOGY AND ETHNOLOGY.

Explorations in the Delaware Valley.—Mr. H. C. Mercer has made the following report to the department of Archeology and Paleontology of the University of Pennsylvania, on the progress of field work.

The study of the ancient argillite quarries at Gaddis' Run, Bucks County, Pa., discovered May 22, 1893, and bearing directly on the problem of the antiquity of Man in Eastern North America, is of great importance, because

(a) These quarries, unlike the jasper mines in the Delaware Valley, recently proved to be the work of modern Indians, are workings by some ancient people in *argillite* (metamorphosed slate with conchoidal fracture), the same stone with which numerous observers assert that Man living on the lower Delaware, at the time of the melting of the great glacier, made his rude implements; because

(b) Granting that glacial man, obtaining his material either at this first outcrop of the rock on the right river bank above his habitat, or from erratic ice-born masses in the river bed, chipped argillite implements at Trenton 7 to 10,000 years ago, we may here learn whether the quarries were the work of the modern Indian, or of an older race—of a stone chipper ignorant of stone polishing, (Paleolithic Man), or of a stone chipper who could also polish stone, (Neolithic Man), and because

(c) The quarries, if the work of the Neolithic Indian, may show us to what extent the use of argillite was continued into recent times, and whether, as at the jasper quarries of Durham, Vera Cruz, Macungie and Saucon Creek, the chipped refuse is scattered with "wasters" or blocked out blades resembling in form the supposed more ancient specimens found in the glacial gravel at Trenton.

The sum of \$19.25 of the \$25 subscribed for exploration by the Board since the last meeting of the American Committee, has thus far resulted in the ascertaining by shafts of the extent of the quarried area, the mapping of the 19 ancient pits and 12 workshops, the study of the quality and fracture of the native stone, the cleaning out of one of the pits and trenching of 2 refuse heaps by shaft A, 21 feet by 15 feet 7 inches by 7 feet deep, and shaft G, 28 feet by 7 feet 6 inches by 3 feet 9 inches deep, discovering 279 chipped leaf-shaped forms and

145 hammer stones, 4 fire sites, and 6 large blocks pecked upon their sides to split with the grain.

The method of quarrying, probably without digging implements, and of fracturing the loose masses without fire, has been studied, while many conditions bearing on the relation of the place to the neighboring river beaches, other possible quarries and the Indian village site at Lower Black's Eddy remain to be examined.

As yet no positive relic of the modern Indian (unless we except 3 hammer stones with pecked sides) has been found, though nothing suggests the labor of a race more ancient, nor intimates that the chipped forms, which have not yet been compared with the Trenton specimens, were finished implements.

The International Congress of Pre-Historic Archeology and Anthropology held its Eleventh session at Moscow Russia, August, 22-30, 1892.

The papers read were as follows:

GEOLOGY AND PALEONTOLOGY IN THEIR RELATION TO PRIMITIVE MAN.—On the composition of the quaternary deposits of Russia and their relation to the works resulting from the activity of prehistoric man, *S. Nikitine*.—A review of the post tertiary deposits in connection with the finding of traces of prehistoric culture in the north and east of European Russia, *Th. Tschernyshev*.—Remarks on the caverns of Oural, *O. Clerc*.—On the remains of a paleolithic epoch in the neighborhood of Krasnoïarsk gouv. de Ienisséisk, Siberia, *J. Savenkov*.—The Russian steppes, ancient and modern, *W. Dokontchaïev*.—On the remains of *Ursus spelæus* and of a fossil *Ovibos* found in Russia, *D. Anoutchine*.

PREHISTORIC ARCHEOLOGY (except Kourganés and Goroditchschés).—A comparison of the primitive industries of France and Asia, *G. Chauvet*.—The latest conclusions concerning prehistoric archeology in Bohemia and its relations with eastern Europe, *Lübor Niederle*.—A study of the barbarian sculptures belonging to the Visigoth epoch in middle France, *C. Barrière-Flavy*.—On nephrite, *Count Cassini*.—On the questionable objects of nephrite found in the Oural *O. Clerc*.—Marks of gnawings on paleolithic and neolithic bones, *Prince Poutjatine*.—The paleolithic epoch in the neighborhood of Novgorod, *B. Perèdolsky*.

KOURGANES AND GORODITCHSCHÉS.—Goroditchschés of bones in northern Russia, *A. Spitzine*.—Deposits of stone implements in the district of Jarausk, gouv. de Viatka, *P. Krotov*.—The "Jalnik" of

Iuriévo, in the district of Borowitchi, gouv. de Novgorod, *B. Pèrèdolsky*.—On the shield cups of the ancient Scythians, *N. Brandebourg*.

ANTHROPOLOGY.—The question of race in Anthropology, *M. Topinard*.—Brain weights of individuals of various Causcasian tribes, *N. Guiltchenko*.—European races and the Aryan question, *Kollman*.—Notes on some skulls, artificially deformed, found in Russia, *D. Anoutchine*.

PREHISTORIC ETHNOGRAPHY.—Contributions to the prehistoric ethnography of central and northeastern Russia, *J. Smirnov*.—Vestiges of Paganism in the region between the headwaters of the Oka and the Don, *N. Troitzky*.—Notes on the questions;—1. Of the co-existing customs of sepulture and incineration. 2. Of certain stone statues called "Kamennya baby," *A. Ivanovsky*.—What is the oldest race in Russia? *A. Bogdanov*.

MICROSCOPY.¹

Methods of Preparing Molluscan Ova.²—The results of my work for the first three months were not promising and it was not until I had hit upon my present methods of preparing surface views of the entire ova that any detailed study of the cleavage could be made. Since I owe most of my results to this method and since I am convinced that it may be profitably employed in the preparation of the surface views of many different objects I believe it merits a detailed description.

The ova were fixed in many different fluids—Kleinenberg's Picro-sulphuric, Picric acid in sea water, Merkel's, Perenyi's, Flemming, stronger and weaker, Auerbach's, Corrosive sublimate, Chromo-formic, Chromo-acetic and absolute alcohol—but none of these methods for a moment compare with the first named, i. e. Kleinenberg's stronger picro-sulphuric. The ova were left in this for a length of time varying from fifteen minutes to one hour and were then gradually transferred to 70% alcohol. They were left in this until all traces of picric acid had been washed out and were finally preserved in 95% alcohol. During the first year of the work many of the preparations were ruined by becoming very dark, owing I think to the extraction of tannin from the corks. This trouble was afterward avoided by using rubber corks, or better still by coating ordinary corks with a thin layer of paraffin.

As a result of many experiments with almost every one of the common staining fluids, I found that the best method of preparing surface views of the whole egg or embryo was the following:—(1) Transfer the object gradually from alcohol to water. (2) Stain from five to ten minutes in a solution of Delafield's (Grenacher's) Hæmatoxylin diluted about six times with distilled water and rendered *slightly* acid by a trace of HCl. (3) Dehydrate and clear in oil of cedar or cloves. (4) Mount in Balsam supporting the cover glass so as to prevent crushing. By occasionally softening the balsam with a drop or two of xylol and slightly moving the cover glass the objects can be rolled into any position desired.

By this method wonderfully beautiful surface preparations were obtained showing with remarkable clearness not only the nuclei and cell boundaries but also the caryokinetic figures and in many cases the archoplasmic spheres and centrosomes. One very considerable advan-

¹Edited by C. O. Whitman, Chicago University.

(²Extracted from a paper to be published later on the development.)

tage of this method is that the preparations were permanent—in fact they become better with age instead of degenerating. All the preparations from which the figures were drawn are still in existence and can be consulted at any time.

I have employed this method with almost as good results in the preparation of surface views of the embryo chick and English sparrow and also with considerable success on other molluscan eggs and embryos as well as those of annelids and echinoderms.

—E. G. CONKLIN, Delaware, Ohio.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

The Congress Auxiliary of the World's Columbian Exposition of 1893. THE PHILOSOPHICAL CONGRESS.—August 21st.—R. N. Foster, Chairman, Henry M. Lyman, Vice-Chairman, L. P. Mercer, A. N. Waterman, Paul Carus, Louis J. Block, H. W. Thomas, Melville E. Stone, Committee on the World's Congress Auxiliary on Philosophy.

Addresses of welcome by the President of the World's Congress Auxiliary and others. Responses in behalf of different Congresses and Countries. Upon the conclusion of these opening ceremonies the Congresses of the several general divisions of the Department assembled in the halls assigned to them and proceeded as designated in their respective programmes.

Address of welcome. Hon. Charles C. Bonney, President World's Congresses. Address introducing philosophy to the audience. R. N. Foster, Chairman of the Committee of Organization.

August 22nd, Kant's Fallacy Respecting the Principle of Causation, W. T. Harris, LL. D., United States Commissioner of Education, Washington, D. C. Teleology in the Modern Philosophy of Nature, Professor H. N. Gardner, Smith College, Northampton, Mass. Present Prospects of Philosophy in Europe, Professor W. Luteslawski, University of Kazan, Oriental Russia. Faith as a Faculty of the Mind, What it Reveals and What it Commands, Professor Thomas Davidson, Keene, Essex County, N. Y. Inquiries into Relations between form of Hand and Character, Francis Galton, F. R. S. London, England. Gioberti and the Synthetic Principle of Philosophy, Brother Azarias de La Salle Institute, Brothers of the Christian Schools, New York City. The Two-Fold Nature of Knowledge, Imitative and Reflective, Professor Josiah Royce, Ph. D., Harvard University, Cambridge, Mass. On the Reconciliation of Science and Philosophy, Professor John Dewey, Michigan University. The Debt of the Moderns to Plato, Thomas M. Johnson, A. M., Osceola, Mo. Ethics of Hegel, Professor J. Macbride Sterrett, Columbian University, Washington, D. C. The Æsthetic Consciousness, Professor J. Steinforth Kedney, M. A., Faribault, Minn. The Underlying Principles of Thomistic Philosophy, Brother Chrysostom, Professor of Mental Philosophy in Manhattan College, New York City. Philosophy and Industrial Life, Professor J. Clark Murray, LL. D., McGill College, Montreal, Canada. A New

Non-tentative and Economic Method of Solving Equations, President J. W. Nicholson, A. M., Louisiana State University, Baton Rouge. Significance of the Realistic Movement in Art and Literature, L. J. Block, LL. D., Chicago. Ethical Aspects of Pessimism, Miss Louise Hannum, Ph. D., Ithaca, N. Y. Insufficiency of the So-called Cosmic Philosophy, Professor Geo. H. Howison, University of California, Berkeley, Cal. Is there a Science of Psychology? Professor Paul Shorey, Ph. D., Chicago University. The Illuminati, Mrs. Mary H. Wilmarth, Chicago. Idea and Purpose of Plato's Republic, Professor H. K. Jones, Jacksonville, Ill. The Duty of Philosophy, Paul Catus, Ph. D., Chicago. Common Sense, Science and Philosophy, Professor B. C. Burt, Ph. A., Ann Arbor, Mich. The Notion of Duty in Modern Ethics, President J. G. Schurman, Cornell University, Ithaca, N. Y. Philosophy of Education, Professor J. E. Bushnell, Kee Mar College, Hagerstown, Md.

THE CONGRESS ON PSYCHICAL SCIENCE.—August 2st.—Ellicott Coues, M. D., Chairman. Richard Hodgson, LL. D., Vice-Chairman. Ernest E. Crepin, Lyman J. Gage, D. Harry Hamner, D. H. Lamberson, J. H. McVicker, Hirman W. Thomas, D. D., B. F. Underwood, General Committee on a Psychical Science Congress.

Addresses of welcome, by the President of the World's Congress Auxiliary and others. Responses in behalf of different Congresses and countries. Opening Address by the Chairman, Professor Elliott Coues. Human Testimony in Relation to Psychical Phenomena, Richard Hodgson, LL. D. A Brief Critical History of the Spiritualistic Movement in America since 1848, Giles B. Stebbins. Spiritualistic Interpretation of Psychical Phenomena, Rev. Minot J. Savage. A Description of Psychical Phenomena in Brazil, Professor A. Alexander. Elementary Hints on Experimental Hypnotism, Walter Leaf, Litt. D. Contributions to the Bibliography of Periodical Literature Relating to Psychical Science, Spiritualism, etc., Benj. B. Kingsbury. Personal Investigations in Psychical Science, M. C. O'Byrne.

August 22d.—Outline of a Project for a General Union for Experimentation in Psychical Phenomena, Dr. Xavier Dariex. Experimental Thought-Transference, Frank Podmore, M. A. The Question of Phantasmal Apparitions, L. Deinhard. Programme for Experimental Occultism, Baron Carl Du Prel. Psychism amongst the Ancient Egyptians, Rev. W. C. Winslow. Psychic Facts and Theories Underlying the Religions of Greece and Rome, Dr. Alexander Wilder. Veridical Hallucinations as a Part of the Evidence for Telepathy, Pro-

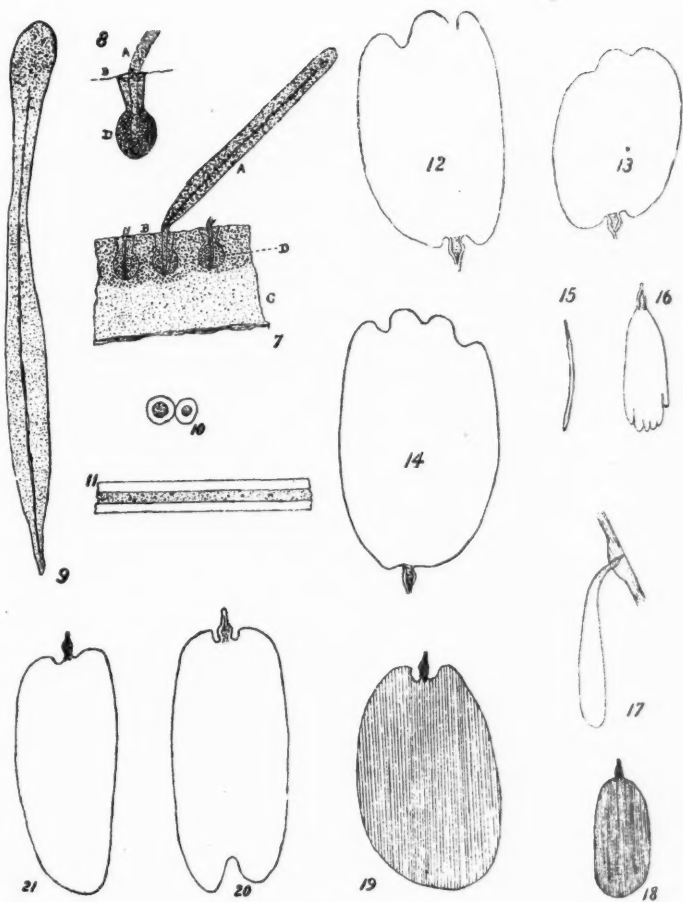
fessor and Mrs. Sigwick. Some Experiments in Thought-Transference and Their Significance, Dr. A. S. Wiltse. Critical Historical Review of the Theosophical Society, Wm. Emmette Coleman. Madame Blavatsky and M. Solovyoff, Walter Leaf, Litt. D. Certain Experiments with the Sphygmograph, John E. Purdon, M. D. Scientific Evidence of the Theory of Reincarnation, Capitano Ernesto Volpi.

August 23d.—The Relation of Consciousness to Its Physical Basis, Professor E. D. Cope. The Subliminal Self, F. W. H. Myers, M. A. Report on the Case of Miss Mollie Fancher, Judge A. H. Dailey. Thought and Its Vibration, Mrs. Hester M. Poole. Experiments with the so-called Divining Rod, Professor W. T. Barrett, F. R. S. E. Dreams, Considered from the Standpoint of Psychical Science, Edmund Montgomery, M. D. On Automatic Writing (so-called), Mrs. Sara A. Underwood. Experimental Crystal Gazing, Mrs. Janet E. Runtz-Rees. On the Alleged Movement of Objects without Mechanical Contact, Professor and Mrs. Elliott Coues. The Religious Significance of Psychical Revelations, Mrs. Elizabeth Lowe Watson.

August 24.—Theories Regarding Automatic Writing, B. F. Underwood. Memory in Relation to Psychical Experiences, Charles Whedon. On the Difficulty of Making Crucial Experiments as to the Source of the Extra of Unusual Intelligence Manifested in Trance-Speech, Automatic Writing and other States of Apparent Mental Inactivity, Professor Oliver J. Lodge, F. R. S. Hypnotic Suggestion, C. G. Davis, M. D. Evidence Favoring the Theory of the Dual Nature of the Human Mind, T. J. Hudson. The Etiological Significance of Heterogeneous Personality, Dr. Smith Baker.

August 25th.—Official Report of the Milan Committee on Experiments with Eusapia Paladino. Translated from the French, with M. Aksakof's Manuscript Additions and Corrections, Professor Elliott Coues. Remarks on Professor Charles Richet's "Notes on the Milan Experiments," Professor Elliot Coues. Further Remarks on the Milan Experiments, Dr. George Finzi. Possibilities of a Future Life, Miss Lilian Whiting. Short Account of Some of the Most Remarkable Psychical Phenomena I have Observed, Señor Alfonso Herrera. Notes of Personal Experiences, Madame E. Van Calcar. Exhibition of "Spirit-Photographs" Known to be Spurious, and of Others Which have been Supposed to be Genuine, with Remarks, Professor Elliott Coues. The Evidence for Man's Survival of Death, F. W. H. Myers, M. A. Papers written by absent authors were read by proxy.

PLATE XXIII.



Androchonia of Lepidoptera.

CONGRESS ON GEOLOGY.—August 21–26.—General Committee of the World's Congress Auxiliary on a Geological Congress: Josua Lindahl, Chairman; W. R. Head, E. Andrews, Victor C. Alderson, Oliver Marcy, T. C. Chamberlin, Chas. W. Rolfe, J. P. Iddings, R. D. Salisbury. Committee of Geological Section of American Association for the Advancement of Science: T. C. Chamberlin, Chairman, H. S. Williams, G. K. Gilbert, R. D. Salisbury, J. C. Branner, J. F. Whiteaves, C. D. Walcott, N. H. Winchell, E. A. Smith, W. J. McGee, G. H. Williams.

Addresses of Welcome by the President of the World's Congress Auxiliary and others. Responses in behalf of different Congresses and countries. Methods of Teaching Geology, Miss Mary Holmes, Ph. D., Rockford, Ill. Physical Geology, Miss Mary K. Andrews, Belfast, Ireland. Chemical Geology, Miss Louise Foster, Boston, Mass.

August 22.—Granites of Massachusetts and Their Origin, Mrs. Ella F. Boyd, Hyde Park, Mass. Artistic Geology, Mrs. S. Maxon-Cobb, Boulder, Colo.

August 23.—The Geology of Ogle County, Mrs. C. M. Winston, Chicago. The Fossils of the Upper Silurian, Mrs. Ada D. Davidson, Oberlin, Ohio.

August 24.—Crinoidea and Blastoida of the Kinderhook Group as Found in the Quarries near Marshalltown, Iowa, Jennie McGowen, A. M., M. D., Davenport, Iowa. The Evolution of the Brachiopoda, Miss Agnes Crane, Brighton, England.

August 25.—The Mastodon in Northern Ohio; Post Glacial or Pre-Glacial, Miss Ellen Smith, Painesville, Ohio. Paleontology, Miss Jane Donald Carlisle, England.

August 26.—Glacial Markings, Miss Thomson, Newcastle England.

August 24.—Address of Welcome by the President of the Auxiliary, Hon. Charles C. Bonney. The General Geology of Brazil, Dr. O. A. Derby, Director of the Geological Survey of Sao Paulo. The General Geology of Venezuela, Dr. Adolph Ernst, Special Delegate from Venezuela to the Columbian Exposition. Pre-Cambrian Rocks of Wales, Dr. Henry Hicks, London, England. The Classification of the Rock Formations of Canada, with Special Reference to the Paleozoic Era, Henry M. Ami, Geological Survey of Canada. The Cordilleran Mesozoic Revolution, Dr. A. C. Lawson, University of California. The Pre-Paleozoic Floor in the Northwestern States, Professor C. W. Hall, University of Minnesota. Distribution of Pre-Cambrian Volcanic Rocks along the Eastern Border of the United States and Canada, Professor George H. Williams, Johns Hopkins University.

August 25.—Huronian versus Algonkian, Dr. A. R. C. Selwyn, Geological Survey of Canada. On the Migration of Material during the Metamorphism of Rock Masses, Alfred Harker, St. John's College, Cambridge, England. Wave-like Progress of an Epeirogenic Uplift, Warren Upham, Geological Survey of Minnesota. Eruptive Phenomena of Brazil, Dr. O. A. Derby, Geological Survey of Sao Paulo. Genetic Classification of Geology, W J McGee, Bureau of Ethnology. Precious Stones and Their Geological Occurrence, Dr. George F. Kunz. The Extent and Lapse of Time Represented by Unconformities, Professor C. R. Van Hise, U. S. Geological Survey. The Phylogeny of Plants, Professor Lester F. Ward, U. S. Geological Survey. The Phylogeny of the Classes of Vertebrates, Dr. O. Jäkel, Berlin, Germany. Restoration of Clidastes (illustrated), Professor S. W. Williston, University of Kansas.

August 26.—Glacial Succession in the British Isles and Northern Europe, Dr. James Geikie, Geological Survey of Scotland. Glacial Succession in Sweden, Hjalmar Lundbohm, Geological Survey of Sweden. The Succession of the Glacial Deposits of Canada, Dr. Robert Bell, Canadian Geological Survey. Glacial Succession in the United States, Dr. T. C. Chamberlin, University of Chicago. Pleistocene Climatic Changes, Warren Upham, Geological Survey of Minnesota. Evidences of the Diversity of the Older Drift in Northwestern Illinois, Frank Leverett, U. S. Geological Survey.

THE CONGRESS ON ZOOLOGY.—August 28.—Stephen A. Forbes, Chairman, Oliver S. Westcott, Vice-Chairman, Edward A. Birge, Secretary, George W. Peckham, William A. Locy, Edward G. Howe, B. F. Quimby, Committee of the World's Congress Auxiliary on a Congress on Zoology. The History and Evolution of American Zoology and the Status and Tendencies of Zoological Science in America, Dr. G. Brown Goode, Director U. S. National Museum, Washington, D. C. The Geographical Distribution of American Animals, Mr. J. A. Allen, Curator of Departments of Mammalogy and Ornithology, American Museum of Natural History, New York. The Effect of Glaciation and of the Glacial Period on the Present Fauna of America, Mr. Samuel H. Scudder, Cambridge, Mass. Preliminary Account of the Formicidae of the North American Fauna, Professor C. Emery, University of Bologna, Bologna, Italy.

August 29.—Lacustrine Zoology: Methods and General Results of Its Investigation, Professor Dr. F. A. Forel, University of Lausanne, Morges, Switzerland. The Plankton of the Muskoka Lakes, Ontario,

Professor R. Ramsay Wright, Professor of Biology, University of Toronto, Canada. The Origin of the Subterranean Animals of America, Professor A. S. Packard, Professor of Zoölogy and Geology, Brown University, Providence, R. I. The Ichthyology of the World's Columbian Exposition, Dr. Tarleton H. Bean, U. S. Fish Commission, Washington, D. C.

August 30.—The Zoological Museum, Mr. F. W. True, Curator of Mammals, U. S. National Museum, Washington, D. C. The History and Special Features of the Economic Entomology of the United States, Professor J. H. Comstock, Professor of Entomology and General Invertebrate Zoology, Cornell University, Ithaca, N. Y. The Special Problems of American Economic Entomology, Dr. C. V. Riley, Chief of the Division of Entomology, U. S. Department of Agriculture, Washington, D. C. The Ornithology of the World's Columbian Exposition, Dr. Frank N. Chapman, American Museum, Central Park, New York City. The Entomology of the World's Columbian Exposition, Professor H. E. Summers, University of Illinois, Champaign, Ill.

August 31.—Undergraduate Courses and Post-graduate Methods in Zoology, Professor E. L. Mark, Hersey Professor of Anatomy, Harvard University, Cambridge, Mass. Kinetogenesis, or the Relation of Motion to Organic Evolution, Professor E. D. Cope, Professor of Mineralogy and Geology, University of Pennsylvania, Philadelphia, Pa. Energy in Relation to Organic Evolution, Professor J. A. Ryder, Professor of Comparative Embryology, University of Pennsylvania, Philadelphia, Pa. Observations on the Loss of Weight in the Tadpoles of Amphibia Anura during the Period of Metamorphosis, Professor Lorenzo Camerano, R. Museo d'Anatomia Comparata, Turin, Italy. Mammalogy and Mammalian Taxidermy at the World's Columbian Exposition, Professor L. L. Dyche, Professor of Comparative Anatomy, University of Kansas, Lawrence, Kas.

September 1.—The Cellular Basis of Heredity, Professor E. B. Wilson, Department of Biology, Columbia University, New York City. Continuity of Organization the Basis of Heredity, or the Organism and the Cell, Professor C. O. Whitman, Head Professor of Biology, University of Chicago. Zoological Psychology and the Development of Mind, Professor C. Lloyd Morgan, Professor of Animal Biology in University College, Bristol, England. Zoological Nomenclature as a Means to a End, Dr. Elliott Coues, Washington, D. C. On Zoological Nomenclature, Dr. Charles Girard, Paris, France.

THE INTERNATIONAL CONGRESS OF ANTHROPOLOGY.—August 28-September 2.—Local Committee of Organization.—F. W. Putnam, Chairman, C. Staniland Wake, Secretary, Edward E. Ayer, James W. Ellsworth, H. W. Beckwith, Frederick Starr, Stephen D. Peet. Executive Committee.—Daniel G. Brinton, President, Franz Boas, Secretary, W. H. Holmes, Representative of American Association Adv. Science, W. W. Newell, Representative of American Folk-Lore Society, Otis T. Mason, Representative of Anthropological Society of Washington, Alice C. Fletcher, Representative of the Women's Anthropological Society, Louis A. Lagarde, Representative of United States Army Medical Museum, and the Presidents and Secretaries of the Sections of the Congress.

August 28.—Addresses of Welcome by the President of the World's Congress Auxiliary and others. Responses in behalf of different Congresses and countries. Address by the President of the Congress, Dr. Daniel G. Brinton. Subject: The Nation as an Element in Anthropology. Physical Anthropology of North America, Franz Boas. Anthropometry of North American School Children, Gerald M. West. Crania from Cuban Caves, Carlos de la Torre. Trepanning in Ancient Peru, Manuel A. Muñiz. On the Anthropological Laboratories of the Department of Ethnology at the World's Columbian Exposition, Franz Boas, H. H. Donaldson, Joseph Jastrow.

August 29.—The Discovery of an Artificially-Flaked Flint Specimen in the Gravels of San Isidro, Spain, H. C. Mercer. The Aboriginal American Mechanics, Otis T. Mason. A Résumé of Archeological Investigations in the Champlain Valley, G. H. Perkins. Anthropological Work at the University of Michigan, Harlan I. Smith. The Mexican Calendar System, Mrs. Zelia Nuttall. On the Antiquity of the Civilization of Peru, Emilio Montes. Cave Dwellers of the Sierra Madre, Carl Lumholtz. Orientation, A. L. Lewis. The Tumuli of Hampshire as a Central Group of Mounds in South Britain, J. S. Phené. The Collection of Games in the Anthropological building, Stewart Culin, J. G. Bourke, Frank Cushing.

August 30.—Alleged Evidences of Ancient Contact Between America and Other Continents, Daniel G. Brinton. Bark Cloth: The Primitive Textile, Walter Hough. Love Songs among the Omahas, Miss Alice C. Fletcher. Primitive Scales and Rhythms, J. Comfort Fillmore. A Peculiar Observance of the Quichua Indians of Peru, G. A. Dorsey. Customs among Natives of East Africa, Mrs. M. French Sheldon. Secret Societies among the Wild Tribes, Stephen D. Peet. The Anthropological Collections in the Government Building. A Crit-

ical Study of Flaked Stone Implements, W. H. Holmes. An Industrial Exhibit based on Linguistic Stocks, Otis T. Mason. Museum Collections to Illustrate Religious History and Ceremonies, Cyrus Alder. Illustrations of a Zuñi Dramatic Ceremonial, Frank Cushing.

August 31.—Ritual regarded as a Dramatization of Myth, W. W. Newell. The Ritual of the Kwakiutl Indians, Franz Boas and George Hunt. The Walpi Flute Observance; a Study of Tusayan Ceremonial Dramatization, J. Walter Fewkes. On the Folk-Lore of Precious Stones, G. F. Kunz. The Fall of Hochelaga; a Study in Folk-Lore, Horatio Hale. The Coyote and the Owl; Tales of the Kootenay Indians, A. F. Chamberlain. Legends of the Bella Coola Indians, Phillip Jacobsen. The Villas of the South Slavs, Friedrich S. Krauss. The Collections of American Archæology in the Anthropological Building. North American Archæology, F. W. Putnam. The Cliff Dwellers, Frank Cushing. Mexican Archæology, Mrs. Zelia Nuttall. Central American Archæology, Manuel M. de Peralta. South American Archæology, G. A. Dorsey. Cache Finds from Ancient Village Sites in New Jersey, Ernest Volk.

September 1.—The Historical Study of Religions; Its Method and Scope, M. Jastrow, Jr. An Ancient Egyptian Rite, Illustrating a Phase of Primitive Thought, Mrs. Sarah Y. Stevenson. On the Sacerdotalism of the Veda, with a Special Reference to the Vedic Hymns, M. Bloomfield. A Chapter in Zuñi Mythology, Mrs. Matilda C. Stevenson. The Religious Symbolism of Central America and its Wide Distribution, Francis Parry. Paper (subject not announced), Grant Bey. Paper (subject not announced), Crawford H. Foy. North American Ethnology, Otis T. Mason. Paraguay, Emil Hassler.

September 2.—The Present Status of Our Knowledge of American Languages, Daniel G. Brinton. Classification of Languages of the North Pacific Coast, Franz Boas. Notes on the Phonology of the Kootenay Indian Language, A. F. Chamberlain. The Affinities of the Egyptian and Indo-European Languages, Carl Abel. Study of the Papuina Language of Central America, Raoul de la Grasserie. The Ethnological Collection in the German Village, Ulrich Jahn. The Pre-Malay Culture of the Malay Peninsula,—Wildman.

THE CONGRESS OF EVOLUTIONISTS.—September 27th 28th, and 29th.—Committee on Organization. Benjamin F. Underwood, Chairman, Lloyd G. Wheeler, Secretary, Professor E. S. Bastin, C. Staniland Wake, J. R. Cummings, Professor E. R. Boyer, Rev. J. Vila Blake, Professor E. G. Cooley, Franklin H. Head, Rev. Jenkin L. Jones, Dr.

Bayard Holmes, Thomas Whitfield, Judge A. N. Waterman. Committee on Programme and Correspondence.—Dr. Lewis G. Janes, Chairman, James A. Skilton, General Secretary, Professor E. S. Bastin, William Potts, J. W. Alfred Cluett, Edward P. Powell, Dr. Robert G. Eccles, Rev. Minot J. Savage, Professor John Fiske, Daniel Greenleaf Thompson, Dr. Martin L. Holbrook, Benjamin F. Underwood, George Iles, Duren, J. H. Ward, Ph. D., Rev. John C. Kimball, Lloyd G. Wheeler.

September 27th.—Opening Address by the Chairman. The Progress of Evolutionary Thought, Benjamin F. Underwood, Illinois. Social Evolution and Social Duty, Herbert Spencer, England. Remarks, By James A. Skilton, New York. Constructive Evolution, Edward P. Powell, New York. Remarks, By Mrs. Celia P. Woolley, Illinois, and Others.

September 27th.—Origin of Variations—Effects of Use and Disuse, Professor Edward D. Cope, Ph. D., Pennsylvania. Evolution of Muscle Fibre—A Microscopical Study, Martin L. Holbrook, M. D., New York. Present Status of Biological Science, Professor Edward S. Morse, Massachusetts. The Inheritance of Acquired Characters—A Botanical Study, Professor E. S. Bastin, Illinois. Weissman's Theory Reviewed, Edmund Montgomery, M. D., Texas. The Marvel of Heredity and its Meaning, Rev. John C. Kimball, Connecticut. Herbert Spencer's Contribution to the Theory of Evolution, Edwin Hayden, Michigan. Charles Darwin—the Man and his Work, Duren J. H. Ward, Ph. D., Pennsylvania. The Poets of Evolution, Mrs. Sara A. Underwood, Illinois. Asa Gray, and America's Contribution to Botanical Science, Professor T. J. Burrell, Illinois. Edward Livingston Youmans, Instructor of the People, Hon. John A. Taylor. The Life-Work of Richard A. Proctor, Miss Mary Proctor, Florida. Emerson, the Prophet of Evolution, William J. Potter, Massachusetts.

September 28th.—The Relativity of Knowledge—Spencer's Unknowable, Benjamin F. Underwood, Illinois. The Relations of Feelings, Herman Gasser, M. D., New York. Evolutionary Psychology as Related to Education, Professor Almon G. Merwin, Ph. D., New York. Constructive Forms of Intuition, John E. Purdon, M. D., Dublin. Psychology in its Relation to Æsthetics, Harvey C. Alford, South Dakota.

September 28th.—The Evolution of the Social Body, Rev. A. N. Somers. Evolution as Applied to Disease in the Progress of Social Development, Bayard Holmes, M. D., Illinois. The Evolution of the Modern Family, Mrs. Florence Griswold Buckstaff, Wisconsin. The

Beastliness of Modern Civilization—Evolution the Only Remedy, Miss Mary A. Dodge ("Gail Hamilton"), Maine. Evolution and the Fair, John H. Copeland, Texas. The Evolutionary Basis of Social Economics, Professor George Gunton, New York. The Relation of Evolution to Political Economy, Charles S. Ashley, New York. Some American Problems of Evolutionary Economics, James A. Skilton, New York. Universal Economic Progress, as Related to Ethical Economy, Alfred W. Smith.

A Symposium of Brief Papers on the following Questions: I. Does the doctrine of evolution, in its sociological aspects, in your opinion, offer wise suggestion for the solution of the grave social and economic problems of our time. II. What, in your judgment, in accordance with such suggestion, should be the next step taken, in our own country, looking toward the solution of these problems? Professor John Fiske, Massachusetts; Edmund Montgomery, M. D., Texas; R. W. Shufeldt, Washington, D. C.; Rev. Myron Adams, New York; Star Hoyt Nichols, New York; F. M. Holland, Massachusetts; Benj. B. Kingsbury, Ohio; T. B. Wakeman, New York; Robert Matthews, New York; L. R. Klemm, Ph. D., Washington, D. C., Bayard Holmes, Illinois, and Others.

September 29th.—Involution and Evolution, Professor Elliott Coues, Washington, D. C. Abstract of Paper on Monism (translated), Professor Ernst Haeckel, Jena, Germany. Evolution of Cosmic Matter, R. G. Eccles, M. A., New York. The Law of Evolution in the Spiritual Realm, Wm. Emmette Coleman, California. The Knowable and the Unknowable, Sylvan Gray, New York. Philosophy and the Aocetrine of Evolution, Raymond S. Perrin, New York. Evolution Optimistic, W. Alfred Cluett, New York. Influence of the Doctrine of Evolution on Ethical Sanctions, Rev. Minot J. Savage, Massachusetts. Intellectual Relations of Morality, C. Staniland Wake, England. Herbert Spencer as a Teacher of Ethics, Rev. Jenkin Lloyd Jones, Illinois. Professor Huxley's Surrender, Dr. Lewis G. Janes, New York. The Evolution of Morality, Rev. H. A. Simmons, Minnesota. The Morals of Evolution, James T. Bixby, Ph. D., New York. The Relations of Evolutionary Thought to the Belief in Immortality, Dr. Charles T. Stockwell, Massachusetts. The Evolution of the Old Testament Religion, Rabbi Emil G. Hirsch, Illinois. The Evolution of Apostolic Christianity, Rev. Howard MacQueary, Michigan. Christianity, in the Evolution of Religious Thought, Rev. Frank N. Riale, Ph. D., New York. The Future of Religious Evolution, Edward P. Powell, New York. The Higher Evolution, Celestia Root Lang, Ohio.

SCIENTIFIC NEWS.

The death is announced of Prof. Alexander Strauch, director of the Zoological Museum of St. Petersburg, and author of several works on Zoology. Prof. Strauch was an authority on reptiles.

According to the *Revue Scientifique* Dr. R. Lydekker started early in August to La Plata, to visit the Natural History Museum of that city. As they go by invitation from M. Moreno, the director of the museum, they will have an opportunity of studying the rich paleontological collections from southern Patagonia which the institution has acquired during the last few years.

Mr. W. F. C. Gurley has been appointed director of the Geological Survey of Illinois by Gov. Altgeld. Mr. Gurley is the author of several papers on paleozoic paleontology, and has a very valuable collection of fossils.

Prof. E. D. Cope has been appointed Professor of Comparative Anatomy and Zoology in the Biological School of the University of Pennsylvania; and Prof. A. P. Brown Professor of Geology and Mineralogy in the Auxiliary Medical Faculty of the same institution.

W J McGee has been appointed Director of the Bureau of Ethnology of the United States.

The distinguished French physician, Charcot, is dead. He had an immense practice in Paris and France, and he will be long known for his researches in hypnotism.

In view of the recent meeting of the Pan-American Medical Congress in Washington, D. C., and of the prospective meeting of the Congress of American Physicians and Surgeons in Washington, D. C., in May, 1894, the Executive Committee of the Association of American Anatomists think it advisable to postpone the next meeting of the Anatomists from December, 1893, until May, when the Association will meet as an integer of the Congress.

A work in folio on the Forest Flora of New South Wales is in preparation, and will soon be issued by the Forest Department of that province. It will be published in quarterly parts, each containing five plates, with their corresponding letter-press of descriptive matter. The illustrations will be in color, and show natural sized flowering branchlets of each species, together with their fruits, barks, etc. Judging from the title page, the work will be an exceedingly beautiful addition to a library.

A volume of scientific memoirs in honor of the late Sir William Macleay has been published by the Linnean Society of New South Wales, and by Dulau & Co., London. It is a royal quarto of 290 pages, with a portrait and forty-two plates and comprises the following papers: The Hon. Sir William Macleay, Kt., F. L. S., M. L. C.; Contributions to our Knowledge of *Ceratodus*, Part I.—The Blood Vessels, Prof. W. Balwin Spencer, M. A. (Plates i-v); The Pliocene Mollusca of New Zealand, Prof. F. W. Hutton, F. R. S. (Plates vi-ix); A Monograph of the *Temnocephale*, Prof. W. A. Haswell, M. A., D. Sc. (Plates x-xv); On an apparently New Type of the Platyhelminthes (*Trematoda* ?), Prof. W. A. Haswell, M. A., D. Sc. (Plate xvi); Observations on the Myology of *Palinurus edwardsii* Hutton, Prof. T. Jeffery Parker, D. Sc., F. R. S., and Josephine G. Rich (Plates xvii-xx); Observations upon the Anatomy of the Muzzle of the *Ornithorhynchus*, Prof. J. T. Wilson, M. B., Ch. M., and C. J. Martin, M. B., B. Sc. (Plates xxii-xxiii); On the peculiar rod-like Tactile Organs in the Integument and Mucous Membrane of the Muzzle of *Ornithorhynchus*, Prof. T. J. Wilson, M. B., Ch. M., and C. J. Martin, M. B., B. Sc. (Plates xxiv-xxvi); On *Parinacochlea fischerii* Smith, C. Hedley, F. L. S. (Plate xxvii); On the Geographic Relations of the Floras of Norfolk and Lord Howe Islands, Prof. R. Tate, F. L. S., F. G. S., etc.; Notes on an Undescribed *Acacia* from New South Wales, Baron von Mueller, K. C. M. G., M. & Ph. D., LL. D., F. R. S. (Plate xxviii); Description of a New *Hakea* from Eastern New South Wales, Baron von Mueller, K. C. M. G., M. and Ph. D., LL. D., F. R. S. and J. H. Maiden, F. L. S., F. C. S. (Plate xxix); A Description of some of the Weapons and Implements of the Alligator Tribe, Port Essington, North Australia, R. Etheridge, Jun. (Plates xxx-xxxv); New Nematodes from Fiji and Australia, N. A. Cobb, Ph. D. (Plates xxxvi-xlii).

The annual Excursion of the Geological Society of France for 1893 covered the region at the Northern base of the Eastern Pyrenees. The region presents a great deal of interest to the Geologist and is remarkably complex, embracing Archean, Mesozoic and Cenozoic beds of several systems.

The Naturalist attached to the Antarctic Sealing and Whaling fleet that recently sailed from Dundee, Scotland, have returned and sent in their reports. They had few opportunities of landing on the supposed Antarctic continent, but they obtained specimens of Eruptive and Schistose rocks, and some fossils of Jurassic age.

